Perfecting the Earth

WOOLDRIDGE

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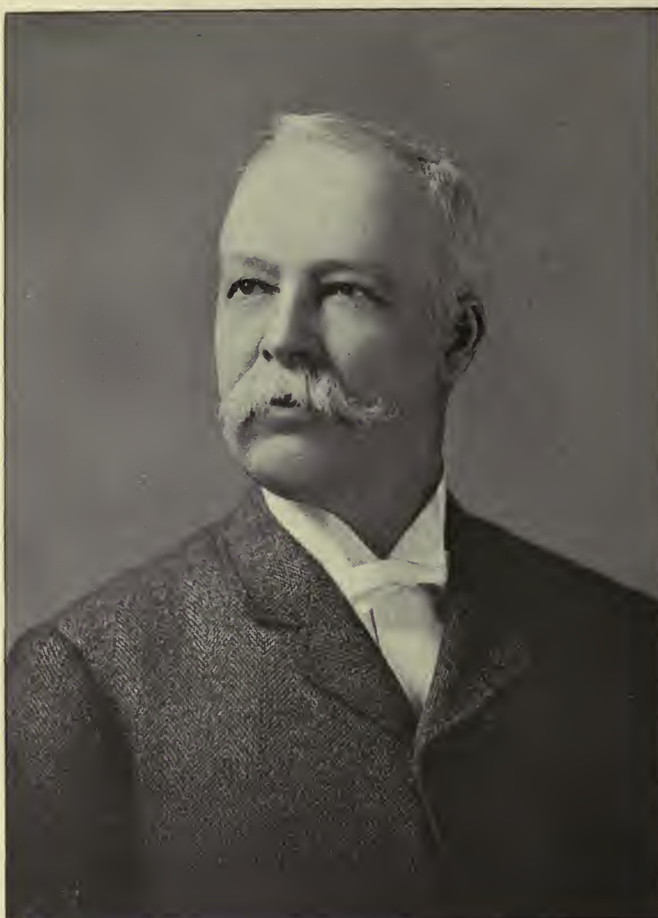

"Let us leave the world
better for our having lived
in it."
Sincerely yours.
C. W. Woolldridge.

Perfecting the Earth

A PIECE OF POSSIBLE HISTORY

BY

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THE UTOPIA PUBLISHING COMPANY
CLEVELAND, OHIO

C. E. Ramage

Perfecting the Earth

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PREFACE.

This is a Utopian book, but its Utopia is not, as Utopias generally are said to be, in the clouds; on the contrary it is worked out with much detail in accordance with a natural order of sequence from existing conditions, with every point definite in time and place, true in all fundamental physical features to the best maps, true also to the law of cause and effect and duly regarding the limitations of nature.

Some to whom this book, in manuscript, has been shown, object that it is too scientific; perhaps it is the most scientific of Utopian books. That Utopias, from Bellamy back to Plato, are in cloudland, unscientific, out of touch with reality and unattainable, is the charge which these critics make, while the logical steps required to make Utopia scientific and plant it on the rocks are the features which, when presented, they most object to. This book, however, is written in the belief that these steps are needed. The aim has been to limit the narrative to the possible, and, following the steps related, to the practicable, while each consequence stated must necessarily follow from the measures preceding. If these details had been omitted, then my Utopia, like the other Utopias, would have been in the clouds and the purpose of the book could not have been attained. If the earth is ever to be perfected, such measures as are here detailed must be taken, and as in the order of nature first things must be done first, so in the plan of this book first things are first related. In necessary sequence from these measures, from a condition natural and probable as things are going, the purpose is to evolve the conduct of a world as it is conceived that the world ought to be conducted, and to plant in the minds of readers a better ideal than that which usually animates mankind.

In building an edifice the foundation must first be laid, but, while the steps in that part of the structure are not without a certain interest in themselves, the interest felt there is mainly reflected from the superstructure and the purposes which it is to serve. In this book the first twelve chapters may be regarded as the laying of a foundation. The building of the superstructure is comprised in the twelve chapters following, while nine chapters at the conclusion of the book portray the life and conditions prevailing in the perfected earth after the work is practically completed.

If anyone sitting down to the repast here presented finds himself growing satiated with the first course and impatient for the ideal conditions that one expects in a Utopian essay, perhaps it might not be asking too much of him that he should pass on for the time to the subsequent parts of the book where such conditions are treated; he will find no better Utopia anywhere than here, and the steps by which this Utopia is made practicable will keep as fresh for another occasion.

The plan of this book not only permits but necessitates a variety in its contents almost equal to that in real life, and it is hoped that for a great variety of tastes it contains something of sufficient value to repay perusal.

C. W. WOOLDRIDGE.

Cleveland, Ohio, March, 1902.

INTRODUCTION.

It is hoped that none of those who may read this book will imagine that the military role which it sets forth is, in the author's mind, the one and only way through which mankind may be emancipated from the bondage of poverty and the ultimate perfection of the earth can be attained. Far otherwise. There are many paths, each leading directly from one of many starting points, and each from such starting point being the shortest and easiest way to reach the desired goal.

The line of progress set forth in this book is simply one of those that will be available if one of the worst tendencies now apparent should come to the consummation described in our opening.

If we should start from where we now are, taking the simplest possible measures that would remedy the evils now existing among us, so that we put an end to the evils, we could not fail to change our social order from the competitive and commercial to the co-operative and educational in doing so, and, this accomplished, all physical works that may be desired are feasible.

Here in the city in which we now write, in the second winter of the twentieth century, we are in the enjoyment of unexampled prosperity. All important newspapers of the city are agreed that this is the fact; they prove it, too, by the reports of banks, by the volume of business transactions as reported in the various commercial bulletins, and by all the various statements and records by which trade and commerce keep track of their doings and conditions.

And yet, in this city, this winter, we have had detailed in our newspapers the tragedy of one man, sober and industrious, the father of a family dependent on his earnings for support,

who, having had the misfortune to lose his employment, sought in vain for months, both in his own city and elsewhere, for opportunity to earn bread for his family now reduced to starvation. Driven at last to desperation, he applied for work in the construction of a water tunnel under the bed of Lake Erie. This is special work, which must be done in compressed air, which none but those trained to it can do, but it seemed his only chance, and to get the job the poor fellow falsely asserted that he had been a tunnel worker all his life. He was employed, and, weakened as he was by privation, before the first day was past he was dead.

Then the newspapers printed his story; charity stepped in and carried food, fuel and clothing to his perishing family. Now they are heard of no more; what may have become of them after that temporary supply was exhausted God may know but the people do not.

Again: an unknown man is found face downward in a snowdrift dead, and the fact comes to light that he has, day after day, been an applicant for work to an employer of labor near the place where he died, begging for employment, saying that he *must* have work because he had a starving family that could not wait. He had been put off from day to day with hope for the morrow, but here he lay dead in the snow. He had found death but not employment.

Another: A young man met the most dreadful loss that can befall a man, he lost his job, and after a few days of fruitless effort to find other employment he gave it up as hopeless and put a bullet through his brain. Another under similar conditions is carried to the asylum insane. These are but a few of the tragedies of life happening within a single month, in a time of great prosperity, in one of the most prosperous of American cities, but for each to whom thus death or madness brings release many suffer no less keenly that their sufferings are continued on and on without cessation. The wounded outnumber the killed, in this as in other wars, and suffer more.

If these things happen now in times of prosperity, to what may not adversity bring us?

Such cases growing more and more numerous, is it too much to hope for, or, O ye business men who so vigilantly guide the public policy in such paths that your interests may in no case be trenched upon, is it too intolerable to be permitted, no matter how many lives may be sacrificed to avoid it, that some American city shall provide opportunity for every one who needs employment to find it and live thereby?

That in the last analysis it is by labor that all are supported none will deny. Shall, then, men able and anxious to render the necessary labor be permitted to support themselves, or shall they not?

That is the question which with greater and greater insistence is ever being pressed on every community in which there are needy unemployed, and no answer but a direct and unequivocal yes will settle that question.

There are four conceivable lines of action along which an effective remedy for the evils of poverty and nonemployment might possibly be reached: (1) by voluntary association of individuals; (2) by municipal action in our towns and cities; (3) by state action, and (4) by national action. But, as matters now stand, every one of these lines of action unless it be the last is hampered and hindered by our laws and state constitutions. If only the machinery of the law would remove its restraining hand we might very soon, either by voluntary association or by municipal action, somewhere plant the public works and public stores necessary to employ the unemployed in supplying their own needs and to distribute to them the product of their own labor. If each town and city had the right of self government in local affairs, including the right to do, for the public benefit, anything which any man or any corporation may lawfully do, it would not be long, I think, before an effective remedy for these evils would be in operation.

In so far as any attempts have hitherto been made by the public to provide employment for needy unemployed, some unproductive, or indirectly remunerative labor, such as work on the improvement of highways, has usually been found for them, work that has always been regarded as temporary, and

the remuneration for which has purposely been kept so meager that no one would desire to continue in it if he could possibly find other employment.

But such expedients necessarily imply that those who own property, and, secondarily, those who are privately employed and living by their labor, meagerly though it may be, must be taxed to provide money with which to pay the wages of such public employes.

Such expedients make no attempt to cure the poverty of their employes but rather carefully avoid doing so, and the employment of the unemployed in this manner is an added burden rather than a relief to the community so employing them. Clearly, no remedy for the evils under consideration can lie in this direction.

If, again, for such needy unemployed, productive work shall be provided in various manufactories, whose products shall be put on the market and a money wage paid to the laborers from the proceeds, the cause which in the first place prevented their employment will be intensified and the condition before intolerable will be made worse.

It is because they cannot sell the output of an unlimited industrial force at a profit, as fast as it can be produced, that private employers cannot employ all who need employment; if, then, the community shall throw an added supply of goods on the market which is unable to buy what is already offered, neither can these goods be sold, and obviously no relief lies that way. It is not because labor is unproductive but because the system of sale for profit interposes between labor and its product that laborers are poor and often unemployed.

Obviously, poverty and unemployment are two phases of the same evil, and there is no way to remove that evil while leaving its cause undisturbed. By the employment of the unemployed in producing directly the things which they need, and distributing their product to the producers, an effective system of exchanges being included in such productive employment, we set aside the cause of the evil. This course will meet no obstacle in itself until all the wants of the employes

are satisfied, and beyond this there will be no need for their employment.

This remedy, however, has been, and doubtless will continue to be, strenuously resisted. The reason of such resistance is because such a remedy must interfere disastrously with business. If the community is producing the things which merchants are trying to sell at a profit, producing them as effectively and economically as they are produced for the trade, and distributing them to the consumers at the labor cost of their production, then, of course; no one will any longer pay dealers' and jobbers' profits on the things which can now be had at their manufacturing cost. If, on the other hand, laborers can now find employment, and receive in compensation the equivalent of the whole product of their toil, they will, of course, no longer labor for the profit of private employers and receive a money wage which represents but a fraction of the value of their product. Obviously this remedy means the end of the whole profit and commercial system.

Hence it may be assumed that practically all who directly or indirectly are living by profits will resist it as long as it is possible to do so. And all who directly or indirectly are living by profits, means all who have any influence on the course of affairs, everybody except laborers, from whom ultimately all profits come.

Hence the hope for this remedy to be applied directly in our cities is remote, and the distress, and destruction of life and character which is likely to precede it, is harrowing to contemplate.

Another way is open along the line of state action, which, though ultimately effecting the same results, might possibly postpone a part of that resistance until the effect on business should be felt, and the opportunities of the new system should also be present to offset that effect.

If the governing power of the state were friendly to the purpose, and legal obstacles were removed, a state such as Ohio might very effectively employ the unemployed in supplying their own needs by establishing two or more settlements

for that purpose so differing in location and industries that they would supplement each other. For instance, a manufacturing town might be planted on Lake Erie, and an extensive agricultural settlement established inland. This latter could, without detriment to its agricultural uses, be so located as to include coal mining among its resources. Then, with a state railway, electric or otherwise, connecting them, and their industries being properly balanced, there would be but a very small portion of their needs that could not be self supplied.

An obstacle to this course to be encountered in the outset would lie in the fact that all land necessary for the purpose would have to be bought from private owners, and the moment any considerable body of land privately owned is desired for public use up jumps the price. The private ownership of land seems to be a great obstacle lying across the threshold of the way to relief either by state action or voluntary association.

To the United States, if the nation would take such action, the way is yet open without encountering that obstacle, and there is no need to wait for a great military army in order to begin, that would be to wait for a condition far less advantageous than that now existing.

The arid lands of the west, that yet remain in possession of the government, seem to me to constitute a great opportunity, an opportunity so valuable that the advantage of its public ownership far more than offsets the disadvantage of the aridity and the remoteness of these lands. There has of late been a growing interest in projects for the irrigation, at the national expense, of such parts of this arid region as may, by methods feasible under present conditions, be irrigable, but much as I would like to see that work done, I cannot but wish that for the present all such plans may come to naught, for the intention is to establish private ownership over all such lands as fast as they may be supplied with water, and when this is done the opportunity which they now present for great things for the good of mankind will be gone.

But, of the few persons who have read this book in manuscript, some tell me that the works described in it are so colos-

sal, so out of relation with the scale of magnitudes to which human enterprises have ever been and yet are limited, that they will seem to most people like a dream of grandeur out of touch with the possible, the product of a kind of megalomania, scarcely sane, and that as such they will drop the subject from their minds without further considerations.

I beg the reader not to do this. Since nations first began they have been wont to tax the energies of their people to the utmost in wars, to marshal them with unity of purpose to ends of destruction, and that continuously for years, until they have been utterly exhausted and in some cases well nigh exterminated.

If now, turning such energy to constructive instead of destructive purposes, nations shall marshal and unify their spare energy to useful ends, the works to which the continuous energy of their millions should thus be given would necessarily be colossal.

There is a great field of usefulness as yet untouched awaiting such colossal works, a field of usefulness that cannot be entered upon except by works thus colossal, and it seems to me a perfectly rational, sane, and legitimate exercise of the imagination, to picture such colossal works and study the effects which can be accomplished by them.

Figure up, if you will, the labor-time and the quantity of material required in order to construct any of the works described in this book, but remember that under the system herein set forth labor-time and quantity of materials are the only expenses that enter into the works. A friend of the author who is a building contractor said: "Why, I figured up the work needed to construct the great dam on the Green river, and I find that it would taken an army of 24,000 men four years, as we figure such work, just to lay the stone in that dam."

Well, if that is all, it is certainly feasible, an army of that size to lay the stone, and another of equal size to prepare it, and a third larger than both to support these and do other needful work, can be had just as soon as it is called for.

And the words, further on, put into the mouth of General Goodwill: "It would be very poor generalship that could not, with modern machinery, on a fertile soil, with half the forces at command, support the whole," is certainly a very moderate statement of an obvious truth.

A good deal less than half, with very inferior means and no generalship at all, is doing it now, after a fashion.

Regarding the labor-time required, however, to do such a work as the Green River dam, it should be considered that on such a work progress will be vastly more rapid than conditions permit on such similar work as is now done. The stone, for instance, in such a work will be laid in blocks as large as machinery can be made to handle with facility, machinery such as building contractors now can neither afford to provide themselves with nor could they utilize it on such work as they are now called upon to do.

The United States could enlist an army of a million, or two millions of volunteer workmen, on the plan of the citizen tenantry hereinafter described, as fast as they might be wanted, if the government would undertake to marshal them and utilize their energies for such purposes as are herein set forth.

Of one condition assumed in our opening chapter it may be as well to speak a word here. We have assumed the condition of the country being at peace but having a standing army of more than half a million of men. Within the last five years the army of the United States has quadrupled. It looks just now as if a halt had been called on the tendency which for ten years, and more, has been so strongly manifested to increase the army, but the motives, which for ten years before the outbreak of the Spanish war led to the cultivation of militarism among us in every possible way, are yet alive. We have also, as a nation, recently expanded into a world-power, vastly more subject to foreign entanglements than formerly we were, and it is not in our blood to accept either encroachments or affronts without resenting them.

We have also undertaken the government of various alien races, the peoples of distant islands, whom we do not propose

to admit as citizens to the enjoyment of the same rights and privileges which we claim for ourselves, and who don't love us as well as they were thought to love us before we undertook to govern them without their consent.

These facts will prevent the possibility of reducing our present military strength, and the first threatening symptom of war with any important nation, to which we are so much more exposed than formerly we were, will surely increase our army to nearer a million than half a million of men.

The opening of this book also assumes a previous political overturn, into the details of which it is not necessary to enter.

Perfecting the Earth.

A PIECE OF POSSIBLE HISTORY.

CHAPTER I.

The year 1913 found the United States at peace and in no danger of war, but nevertheless possessing an army of 553,000 men.

The people had grown sick and tired and ashamed of the military role in which for sixteen years and more they had allowed themselves to be led, and once more had asserted their allegiance to the principles of the old Declaration of Independence, that government rightfully exists for the purpose of securing to the people their right to life, liberty, and happiness, and derives its just powers only from the consent of the governed.

The idea which had prevailed during the preceding epoch was that the true purpose of government was to preserve order while business men amassed wealth; that it rightfully derived its authority from the will of the owners of the wealth over which it held sway; that "those who have no stake in a country ought not to have any power to control its policy"; that the just powers of government being derived from the consent of the governed is nonsense, good enough to amuse the foolish masses with while business men manage affairs, but not for a moment to be taken seriously as a basis for the practical conduct of government.

Now, however, this unbusinesslike and impracticable principle had been reasserted, and in accordance with it the Ameri-

can garrisons had been withdrawn from outlying parts of the earth, leaving the people of those regions which had been occupied, free to govern themselves according to their own desires, but with the privilege secured to all Americans to reside or trade in them with all the rights and privileges pertaining to their own people.

But, as we remarked in the outset, this left the nation with an army of 553,000 men for which it had no use nor need, nor any prospect of such a need.

The maintenance of this army was a grievous burden, but the way was not clear to disband it. Those who owned the wealth of the land, a class that had for a long time been growing more wealthy and less numerous, assured the nation that it was enjoying the acme of prosperity. They, the rich, no doubt spoke truly for themselves; the newspapers, which they owned, with great unanimity echoed the assertion, but, nevertheless, the multitude of the people found it hard to live and make ends meet.

In addition to the army of the United States, which the people found it so hard to maintain, the army of the unemployed had continued to grow, and they too had to be maintained in some manner by those who worked. If the army were disbanded there was no place in the ranks of the usefully employed that could receive the soldiers, and the army knew it, consequently the army objected to disbandment.

On the other hand the people, knowing that the disbandment of the army could only result in turning the soldiers loose as an addition to the army of the unemployed, a swarm of tramps, whose military training would make them formidable and whose miseries would drive them to crime, hesitated to ask for their disbandment, even though the maintenance of this

great army was a burden from which they greatly desired release.

General Theodore Goodwill had recently come into command, and, realizing the situation, he sought permission from the administration to use the army in constructive work for the public benefit, along lines which he would explain in detail to a commission authorized to pass judgment on the merits of his plans. He claimed that if given power to use the army as he wished he could relieve the distress of the situation by accomplishing three objects, each greatly to be desired, namely, first, he would soon make the army self-supporting; second, he would make army life wholesome, and ultimately lead the soldiers out of military life into free citizenship; and third, he would make world improvements which would be a blessing to mankind, and especially to the United States.

Since it would for sometime be desirable to keep the purpose and character of some of his contemplated works a secret, he asked for the appointment of a commission of scientific men, whose judgment would command the respect of the world, to consider the practicability and soundness of the projects which he would explain to them, and which commission should have power to sanction or reject the same, and he suggested that the chief officers of the U. S. Coast and Geological Surveys, and of the weather bureau, might appropriately be made a part of that commission.

The proposition of General Goodwill was laid before Congress in a special message, and after due consideration, the President was authorized to appoint such a commission as the General had requested. The General laid his plans before the commission, which, after considering them for about a month, during which time he was frequently called before it, in order to explain and elucidate certain points, with some slight modi-

fications his proposition was accepted, and he was authorized to employ the army as he desired.

In accordance with the program thus adopted, immediately following this step came an act of Congress, which had been called in special session for that purpose, withdrawing from sale all desert, forest or mineral lands lying west of the Minnesota, Iowa, Missouri, Arkansas, and Louisiana state lines, and repealing all laws providing for the sale or alienation of government lands in so far as they applied to the territory designated. This bill was signed by the President and took effect immediately.

As soon as this measure had become a law, in October, 1913, a force of 1,000 surveyors and engineers, officered by young graduates of West Point, was sent to Salt Lake City, Utah, to act under the direction of the U. S. Geological Survey, to whose chief the commanding officer was directed to report for orders.

The purpose of this expedition was to make topographical surveys, supplementary to work previously done by the geological survey in the states of Utah, Nevada, Wyoming, New Mexico and Arizona, such that by their aid dams and irrigating canals could be located and constructed to the best advantage on the streams tributary to the Colorado river and elsewhere in the region designated; to report the character of the ground, and timber where it existed, and also to note and report the location of all out-cropping mineral deposits and rock formations.

Another force of 500 surveyors and engineers was at the same time sent to Los Angeles to make a similar survey of Southern California from the Pacific coast to the Colorado river. This force was to act under the direction of the Coast

Survey, and was required to plat the whole region with great minuteness, especially with regard to altitudes.

These preliminary measures having been taken, the world was treated to a novelty in the following general order:

"To the army of the United States. Soldiers: You are now in the happy condition of having no human enemy, nor any probability of an enemy. Nevertheless, conditions are such that to disband you could not fail to produce intolerable evils both to yourselves and to the people among whom you would be scattered. In view of this situation the administration has determined to utilize your energies in the conquest of nature, so far as nature remains unfriendly to man.

"In pursuit of this object, you are to be employed in the construction of works, greater than anything hitherto attempted by man, for the purpose of turning deserts into gardens; at the same time you are to be so distributed, and your energies are to be so employed, that you will, as a whole, at the earliest possible moment, become entirely self-supporting. Hitherto the work of armies has been destruction, henceforth your work will be construction, and with this change of purpose it is confidently believed that a better era for mankind has dawned.

"Fearing no enemy to destroy, your camps under the new order will assume the character of towns, constantly improving in beauty and convenience.

"Your remuneration will, as rapidly as it is possible to make it so without calling on others to provide it for you, be made to approximate a good livelihood, and for merit and ability you may expect promotion. Pending active operations, you will receive instructions in the use of machinery, while your military drill will be limited to your orderly movements about your camps and to and from your instructions.

Signed, THEODORE GOODWILL,
General commanding."

This order was received with great enthusiasm both by the army and the people.

Preliminary reports from the field enabled General Goodwill to place 10,000 quarrymen and stone cutters at work in eastern Utah that same autumn, railway connections being made with the Union Pacific line to the camps in order to secure them against any failure of supplies. Machinery was already waiting for their use.

An order was issued that the colonels of the several regiments should call for ten volunteers out of each company for this service. This called out about 54,000 men, from whom, after examination, the required number of men, such as were likely to make the most effective workmen, were selected and sent forward to the work.

Another ten thousand selected in a similar manner were sent forward within a week, to be employed in camp and railroad construction. It being known among the soldiers that steam excavators, wire cable carriers, and other machinery, the most powerful in existence for the purpose, would be the means by which as much as possible of the required work would be done, to be selected and sent on one of these earlier expeditions was deemed an honor much to be desired.

During the fall and winter following, special instruction was given to the soldiers who remained in the camps and barracks, not only in the use of machinery and the technical arts in general, but in their application to the special lines in which it was anticipated that the services of selected forces would soon be needed, and special aptitudes were noted and cultivated. In this manner men were selected for several lines of special service, a body of 20,000 iron workers among others, being put under instruction and training for the various arts required in smelting, casting, rolling and manufacturing the varied forms of iron, and the machinery that is built from it, but for which we should, today, be as feeble in our power to

create wealth and transform the world as they were in the middle ages.

As soon as the melting of the winter snows would permit work in the field of operations, other men were hurried forward. Ten thousand men with the machinery for making their work most effective, for the purpose of grading and excavating irrigating canals, and one thousand brick makers, with the machinery needed in their art, to provide material for building the great iron works, which were so urgently needed, were the first force sent forward in the spring of 1914. These were quickly followed by others, until, before the middle of May, for miles along the line laid out for the construction of the main irrigating canal, steam excavators were puffing and scraping at intervals of a quarter of a mile, a railway track was graded and built along its upper border, and cable carriers for removing the earth were beaded with great buckets moving out with their loads and returning empty to the excavators, while at each rocky point the quick hammering of power drills deafened the ear, and at every ravine and hollow aqueducts of stone were in process of building. A hundred ample forces of men were at the same time employed at a hundred correlated tasks, and before the first of June more than 200,000 men were effectively employed in the field of these initial operations.

This season the greater portion of the force employed was concentrated near the junction of the Uintah river with the Green river in northeastern Utah. The main irrigating canal was here laid out in a course extending generally from east to west along a line coinciding with the altitude of 5,462 feet above the level of the sea, cutting off a V-shaped peninsula of land, below that level, lying between the canyon of the Green river and that of the Uintah.

The distance from the canal due south to the point of the V was about twelve miles, while that from the eastern limit of the tract on the border of the canal to the bank of the Uintah on the west was about sixteen miles; the entire tract comprised about 100 square miles of land, and this was the area which it was proposed to irrigate and sow with wheat this first season.

On the other, or north side of the canal, the ground rises with a somewhat steeper inclination to the foot of a terrace which lies at a distance from the canal varying from one mile at the eastern border of the tract chosen for the first season's irrigation to four miles at its western limit. The top of this terrace generally coincides with the level of six thousand feet above the sea, the territory above its escarpment forming a nearly level plateau about four miles wide extending to the foot of the Uintah mountains.

On this plateau above the six thousand feet level, it was determined to build the city; the temporary camps, however, were laid out on the slope between the foot of the terrace and the canal.

The course of this canal was laid out with the view ultimately to collect the waters of the Green river and its tributaries, but the works required to accomplish that end were so great as necessarily to occupy several years. The north fork of the Uintah alone, however, offered an ample supply of water for this season's field of irrigation, and the work was so ordered as to utilize that stream for the purpose.

CHAPTER II.

Let us take a look at the region which has become the seat of these various operations, while it is yet unchanged by the hand of man.

The country here lies high and bare. Ranged along on the north are the towering peaks of the Uintah mountains, some of them snow-capped all the year. To the westward the Wahsatch range bounds the horizon. To the southward, across the slope of land chosen for irrigation and beyond the united canyons of the Green, the Uintah, and the White rivers, but appearing very near, rises a mountainous swell stretching down from the Wahsatch range on the west and reaching the Rocky mountains in Colorado on the east, but broken in the middle by a notch through which the Green River canyon passes toward the south. Through this notch, dim and azure in the distance, can be seen the peaks of the mountains through which the grand canyon of the Colorado cuts its way. The eastern horizon is broken by the great peaks of the Rocky mountains. The land near by lies in long gently undulating slopes, too arid for agriculture, with here and there a scattering growth of bunch grass which pushes forth in the spring and then drying where it grows, affords a thin picking of natural hay on which the buffaloes used to live. Of other vegetation there was the omnipresent sage bush, and a few other hardy shrubs; other plants were there also, of many kinds, but mostly so inconspicuous that the careless eye was apt to overlook them, and one needed to be something of a botanist to see them all; with all these plants, however, the arid barrenness of the earth was scarcely relieved.

These slopes and terraces are cut at intervals by deep ravines in which flow the streams which, coming down from the mountains all about, unite to form the Green river, and this, uniting with another similar stream gathered farther east in the mountains of Colorado, forms the great Colorado river.

The great peaks of the Uintah mountains on the north, towering a mile and a half above the level of the canal, seem close by, though their distance is from thirty to sixty miles away. These peaks themselves are but pinnacles of the crest of a great rugged swell forming the whole mountain group. In mountains there are two sites of greatest ruggedness, first the ravines at their bases and second the peaks and crests at their summits, the middle heights are usually smoother ground, but there is very little of this state of Utah below the altitude of 5,000 feet. In these Uintah mountains in rain and snow much more water falls than on the lower levels, three times as much or more. Great works are required to utilize it, but when the works are built there is water enough for irrigation and for power. There is timber, too, in these mountain ravines and valleys, though timber is a scarcity in this region.

This is a picturesque country, gloriously so in its landscapes. The distant mountains appear in colors more brilliant, clear and beautiful than are ever seen at lower altitudes and in more humid regions, the color varying with the distance, the time of the day, and the condition of the atmosphere. The most distant points are of the faintest blue, scarcely distinguishable from the sky above them; on the nearer peaks and ranges the colors deepen into purple, indigo and blue; on the shady sides and the ravines of the mountains, especially at distances of from forty to sixty miles, these colors are often of the richest and most delightful tints imaginable. Nearer than this the earth tints modify the colors. The nearer peaks and mountain

walls are mostly dark, but where the light reflects to the eye they show something of the color of the rocks, slate color, reddish brown, occasionally a patch or seam of white, but everywhere overspread with a bluish haze. Even looking down from a mountain height into a valley at your feet, or up from that valley to the nearest height, gives distance enough for this.

Yet it takes some time for a newcomer from the east to get his mind adjusted to the new scale of distances that is here spread before his eye. Ten miles here appears scarcely equal to one as he has known it elsewhere, and if he mounts a horse for a journey the earth seems to run under him like a treadmill while he makes no progress. Even a railway train may run all day approaching and rounding some prominent mountain group which vanishes from sight in the rear of the train as night closes in on the scene, and the traveler can scarcely realize that he has during the day covered more than a decent day's drive for a horse and buggy. The apparent extent of a tract of territory depends on how many times it contains what can be seen at once, and judged by this test the territory of New Mexico, though it contains about four times as many square miles as all Ohio, is not equal in apparent magnitude to the smallest Ohio county. But let us not wander from the scene of our story.

The plains and terraces of this region are varied by the mesas—the Spanish for tables. These are flat-topped elevations bordered by abrupt declivities. They look like remnants of a former higher level of the earth, which they are, for some cause left unfinished when the general level of the country was graded down two, or three, or five hundred feet. Some of these mesas have been whittled away at their bases until they

have become peaks, and of others there are mere stumps left, rocky warts on the otherwise smooth surface of the earth.

These features give variety to the nearer view, but in spite of the beauty of the landscape, the foreground looks dry and barren and dreary. All the water comes from the mountains and runs in the canyons; the surface of the earth is not refreshed by it.

Excepting for the scarcity of water on these plateaus from 5,000 to 6,000 feet above the sea, the climate is well adapted to wheat, and the grains, grasses and fruits of the northern latitudes of the United States. There is a sharp winter here, but with water enough in the canyons to irrigate the earth, with power enough in the streams for every use, labor and skill only were needed to utilize these resources in order to make a garden of this desert. Hence its choice as the first field of operations designed to make the army self-supporting while engaged in other and greater world improvements.

Before the first days of summer had come, the great iron works were ready to begin operations, abundant deposits of excellent iron ore had been discovered and mines had been opened, and on the coal lands, of which in Colorado and Wyoming there were thousands of square miles yet belonging to the government, with unlimited quantities of the finest coal, preparations were making to secure an ample supply of coal for all purposes. Railways were constructed to connect these iron and coal mines with the new iron works and with the world, and by the end of June 200,000 more of the army were provided with employment in this Utah field, or a little more than 400,000 men all told.

In coal and iron mining, however, the army was not employed. For many years the coal miners of the United States had lived in the most extreme and degrading poverty,

their pay insufficient to support a civilized life, and with an army of unemployed at all times among them. The military authorities now saw an opportunity to make an end of this distress. A sufficient number of enlisted men was sent to the sites where coal mines were to be opened to establish camps there in the form of tasteful villages of neat and convenient houses, with sewers and waterworks and every sanitary requirement supplied, also with schoolhouses and lecture rooms and everything needful for the mental and moral upbuilding of their people, and then the following advertisement was published in all the coal mining districts of the United States:

WANTED:

Coal miners, to operate mines connected with the works now in progress by the military forces of the United States.

Coal miners accepted for employment under this call will be required to work but eight hours per day, and their compensation will be sufficient to secure to them and their families a good living with a pension for their support when disabled by sickness or accident or old age. Houses, clothing, food, and educational privileges for themselves and their children, will be provided by the government, and they with their families will be enrolled, not as a part of the army, but as citizen tenantry of the United States.

They will have all the rights and privileges of free citizens, electing their own municipal and civil officers and conducting their public affairs in accordance with the laws of the land; the United States will simply be their landlord and their employer.

An office for the examination and enrollment of applicants was opened wherever such an office was needed and to such as were accepted, transportation was furnished for themselves and their families to the places where they were wanted. Of course, there was no difficulty in securing the services of as many men as were required.

This measure was taken in May, 1914. The iron mines, also, were manned in precisely the same manner.

At this measure, of course, the wrath of the coal and iron mining capitalists knew no bounds. They tried to avail themselves of their old time refuge in the courts by inducing a judge to declare the new policy unconstitutional on the ground that it destroyed the value of their property without compensation, but they soon learned that the operations of the army of the United States were not to be prevented by the mandate of a judge, even though they had made and owned the whole supreme court, and the judges knew better than to try it. They tried to avail themselves of the power which so often in the past had served them to crush a rival through their other selves, the railroad companies, by charging ruinous rates for transportation, or by professing inability to provide cars where and when they were needed, but the railway companies were notified that if they did not render the services required of them at reasonable rates the government would seize and operate the roads. The privately owned railways, however, did not run to the points where the coal was mined, nor to where it was needed; there the government was building its own railways as well as working its own mines. They tried to discourage the government in its new policy by ruinous competition, so as to give the officials a pretext to say, as of old they were always ready to say, that public coal mining did not pay, since private enterprise was producing cheaper than the government could mine it, but the officials were not now so blind and idiotic as, for a consideration, officials used to be, and the government mining went on.

To hold their miners the coal mining companies were now under the necessity of giving them a much better livelihood than coal miners had ever before been able to obtain, and

in the course of the new competition the wages of miners went up and the price of coal went down until there was no profit left for dividends, and when it became evident that the new army policy was to be permanent, capitalists began to withdraw from coal mining and whole districts were abandoned by their owners. The value of coal lands sank to nothing, and many of the most important fields were allowed to relapse into public ownership through the nonpayment of taxes; but as fast as miners were thrown out of employment by the withdrawal of capital they were re-employed in the government mines. In this way the degrading poverty that had so long been associated with a coal miner's life was done away with.

But for the fact that the capitalists had been enemies of the new policy from the beginning, these developments had, of course, made enemies of them by the thousands, but where thousands of the rich had become bitter and irreconcilable enemies, the new policy had made millions of friends among the masses from whom the rich had formerly drawn their substance. It soon became evident to the millions that the former value of the property of these mine owners had consisted simply in their power to oppress their employees on the one hand and the consumers of their products on the other, thus making the oppression universal.

CHAPTER III.

Meanwhile, in the Utah field of operations, wherever on any special piece of work there was need of hurry, ample force was detailed to hurry it. As we have seen, before the end of June there were more than 400,000 men employed there exclusive of the coal and iron miners who were drawn from civil life. By the first of July the great smelting furnaces were pouring forth iron in enormous quantities, and simultaneously with the smelters other departments were set in operation to utilize the product before it had time to cool. There was the Bessemer steel department with its converters and rolling mills producing structural steel, which at this time was largely employed for spanning ravines and canyons with aqueducts and bridges, and steel rails, and tempered rods which were passed on to the wire mills and manufactured mostly into steel wire cables which in lengths of a little more than a mile were wound on reels and stored for use a little later. There was also the branch produring steel in forms suitable for the manufacture of machinery and tools and implements, and the machine shops where all the various kinds of machinery required, especially dynamos, were manufactured. But the greatest department of all in these great iron works was the pipe foundry. This was greater than all other pipe foundries in the world taken together. Its task was to produce more than 220 miles of great water mains within ten weeks.

The first lot of pipe was cast immediately after the fourth of July, 1914, and there were, as there was need to be, many miles of great pipe produced at a casting. The slag from the smelting furnaces, also, was drawn off into moulds and con-

verted into such forms as would make it most useful. These and all other fixed industries were each located according to a general plan adopted in the beginning of operations, which may be understood from the map accompanying the next chapter. The permanent camp or city site was on the terrace above the 6,000 feet level. Radiating through a center chosen in this city site, four main avenues were located, one in the meridian line through that center, another at right angles with this, while the other two bisected the quadrants along the lines from northeast to southwest, and from southeast to northwest.

The industrial works were planned to occupy a portion of the tract below the city terrace but above the irrigating canal, and the section of this tract lying between the western continuation of the avenue extending directly westward from the proposed city center and the southwest avenue, was devoted to that purpose. This section bounded by the foot of the city terrace, the avenues mentioned, the irrigating canal and the Uintah river canyon, as may be seen from the map, comprises an area equal to half a township, or eighteen square miles. On this tract near the border of the canal and extending along the southwest avenue the iron works were located, and other industries in such relation to these and the contemplated city as would give the greatest economy in their working. The temporary camps lay on the same side of the canal, to the eastward of the industrial tract, between the southwest and the southeast avenues.

The irrigating canal, until near the middle of August, remained a dry excavation with a railway track along its upper or northern side. The works preparatory to the irrigation and sowing with wheat of the triangle of land lying south of this canal and included between the Green river canyon on the east and that of the Uintah river on the west at this time occu-

pied a large proportion of the force employed in this region. The most conspicuous of these works was an aqueduct extending directly south from the canal to the southern point of the peninsula in such a manner that it divided the distance between the two canyons as nearly equally as possible. The length of this aqueduct is a fraction over twelve miles. It was designed to hold the water at an elevation of from 25 to 75 feet above the land to be irrigated from it, and to serve as a reservoir of still water as well as a channel to carry a stream, but in the course of its twelve miles of length the land sinks away to a level more than 400 feet below that of the canal.

This difficulty was overcome by building the aqueduct in distinct sections: The first section, to hold water on the same level as that in the canal, extends southward until the land has so fallen away that the height of the aqueduct is fifty feet. Here a new section begins, 25 feet below the level of the first; this continues in the same line, until, as before, its height is 50 feet. In the same manner each section is succeeded by another at a level 25 feet below the preceding, until the lowest level is reached at the border of the canyon. This aqueduct is built of cut stone, on arches, in a style equal to the best of Roman workmanship; it carries a volume of water ten feet wide by seven feet deep, and each section opens into the next below by an automatic valve gate controlled by a float on the lower section. For three miles from its point of departure from the main canal, this aqueduct is not designed to discharge any water, but beyond that point it is fitted with discharge gates opening into stand-pipes at intervals of half a mile. In building this aqueduct the work was going on throughout its entire length at the same time, a railway track having been constructed to carry the stone from the quarries in the beginning; thus the entire structure was completed within six weeks

from the time it was begun, and that without any particular hurry.

The land for irrigation was laid out on each side of this aqueduct, beginning at the point where the discharge gates and stand pipes begin, in sections half a mile wide, at right angles with the aqueduct and extending to the canyon borders in either direction.

Along the lines of division between these sections water pipes of 18, 24 or 30 inches in diameter, according to the area of land to be supplied from each pipe, were laid on beds of masonry, and above these pipes strongly mounted in the same structure of stone, pulley shafts were placed, and all connected with motor dynamos. This whole arrangement was covered with sheds and an electric railway track was constructed along the front of each shed.

When these water mains were laid they were fitted at intervals of 300 feet with plugs for four inch hose, a quarter of a mile of such hose to each plug was provided and stored in the power sheds where it was wanted.

The land irrigated from this aqueduct is bounded on the north by a straight east and west line drawn through the point where the first outlet gate was constructed, three miles from the point of departure of the aqueduct from the canal. Between this line and the canal is a tract varying in breadth from a little less than three miles to five and a half miles. This was laid out in similar one-half-mile sections, equipped with water mains and power shafts in the same manner as those irrigated from the aqueduct, but at right angles to them, that is with the division lines and power sheds running north and south.

This portion of the tract, which receives water directly from the canal, is greater in area by one-half than that watered from the aqueduct. The portion of the canal to be finished

this year was limited to a section 18 miles long, beginning at the point of its nearest approach to the Green river canyon just east of the tract to be irrigated and terminating at the passage of the north branch of the Uintah river on the west. At this point, a substantial dam, of cut stone laid in cement, and founded on the bed rock, was built to retain the water to the height of the canal, 87 feet above the bed of the stream. This forms a fine storage reservoir for the canal.

This north fork of the Uintah comes down by nearly the shortest possible course from the highest parts of the Uintah mountains; its course lies mostly through a wild ravine with a succession of cataracts and cascades and rapids throughout its entire length. At a point about 20 miles up the stream from the storage reservoir, near the 9,000 feet altitude line, there is, however, a length of nearly two miles in which the total fall is not more than 20 feet. At the foot of this level reach, the bed rock was cleared of earth and mortised to receive the foundation of a massive dam of cut stone which was built across the ravine and carried to the height of 75 feet. This formed a lake two miles long by three-quarters of a mile wide in which all sediment subsides leaving the water perfectly clear, an ideal source of supply for the future city. From this reservoir the water is conducted down the descent of 3,600 feet to the storage reservoir of the canal by nearly level reaches alternating with steep descents of from 50 to 75 feet at a leap; at which points power stations were constructed.

On the west and larger fork of the Uintah another dam and feeding reservoir was also constructed. This dam is 22 miles west of the storage reservoir which is on the north fork, and just below the confluence of an important tributary with the west fork, but its altitude is only about 500 feet above that of the storage reservoir. This 68 feet dam in fact lifts the


White River Dist.
Agricultural Land.
White River
Green River
The Fort Goodwill Peninsula.
Uintah River.
Western Div. Agr. Land.
FORT GOODWILL
Main Irrigating Canal
Main Canal
High Level Irrigating Canal
Uintah Mts.
THE FORT GOODWILL AGRICULTURAL DISTRICT.

water just to the 6,000 feet level, where it forms a fine forked lake, one arm of which is five miles long and the other three and a half. From this reservoir the water is conducted through a feeding canal which closely follows the 6,000 feet contour line allowing only about one and a half feet fall per mile. This secondary canal also intercepts several smaller tributaries along its course; it is constructed to have a width of 25 feet on the bottom and to carry a depth of from six to eight feet of water. This channel makes available for irrigation a fine tract of land that lies above the level of the main canal. When it approaches the north fork there is a fall of about 500 feet, over which the waters are conducted before they reach the storage reservoir and the main canal. To effect this descent the water is carried from one level to another through power stations similar to those on the north fork.

A few of the many other works in progress should be mentioned. The quarrying and cutting of stone was, as we have seen, the very first undertaken. Just above the storage reservoir, on the north fork of the Uintah, where, going up the stream the cascades began, is the outcropping of an immense deposit of hard, grey sandstone, thick bedded in horizontal strata. Here the quarries were started in the beginning, and here the stone was cut and prepared for the reservoir dam, for the aqueduct, and for the many other uses for which much was needed in preparing all these works and building the future city. For the dam forming the high level reservoir suitable stone was quarried in the mountains above.

Railway tracks, adapted for steam locomotives at first, but ultimately to be operated by electric power, were built to connect these quarries with all other works. This was very necessary, since horse power was used in the very earliest prepara-

tions only, and very little then. In great works horse power is very expensive.

The railway up the north fork of the Uintah to the high level reservoir was made double tracked to operate as a gravity road, the cars being attached to a cable passing over a drum, loaded cars coming down drawing the empty ones back. Along the course of this gravity line are the lime kilns and the cement works, for which abundant material exists along the way. On the tract devoted to industries, just north of the iron works and extending to the canal, about two square miles of clay land was reserved for brick, tile, and architectural terra cotta works. On southwest avenue, between the iron works and the city terrace, are the machine shops, the hose factory, the coal depot, and the gas works, with ample sites reserved for many other industries to be established later. All these works were from the beginning planned on a large scale, and in none of them was it intended long to use, steam as a motive power, everything being planned for operation by electricity.

Two other industries for which, among the earliest of these operations suitable buildings were erected, on southwest avenue nearest the foot of the city terrace, deserve special mention; these were the cooking department, and, a little farther down the avenue, the laundry. In the cooking department through the summer of 1914 the food was prepared to supply the needs of more than 400,000 men. The task seems immense, but armies must be fed. Industrial armies, especially, deserve to be well fed, and, great as the kitchens had need to be, in which the food was cooked for 400,000 men, it is obvious that cooking can be better done with less expenditure of energy, and less waste of time in well equipped kitchens and by expert cooks, than about camp fires with camp utensils, by men detailed in turns from the companies.

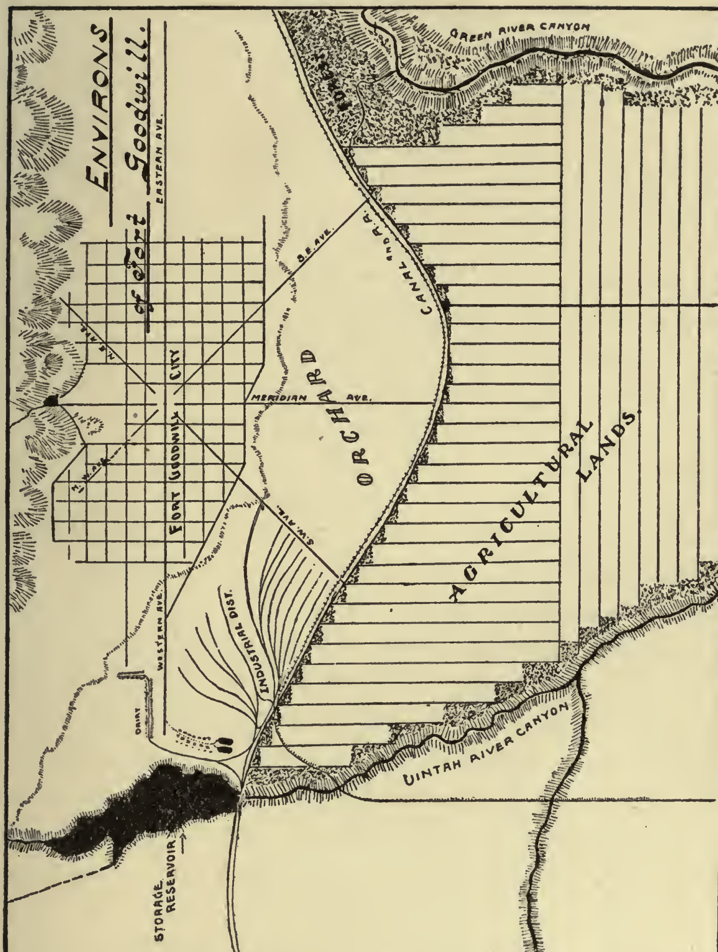
As with the food of the army in this respect, so it was with their washing. If the care of the clothing of a large body of men, especially in camp life, is left to themselves, it means dirt and vermin and disease and degradation, all of which, doubtless, have always been inseparable from the military operations of war, but which would be a reproach and a shame to the industrial army, besides destroying its efficiency. To prevent this, this great laundry was established in the very beginning. With the best steam apparatus, its capacity was enlarged as fast as the forces gathered, until its weekly duty was to cleanse the garments of more than 400,000 men. No such laundry had ever before existed or been thought of. Here came the soiled clothing of the army in company, detachment, and regimental packages, working uniforms and underclothing. It was found to be economy that every man should have two suits and change weekly, and here every piece received the treatment appropriate to its cleansing, was repaired where repairs were needed, and, perfectly laundried and renovated, the regimental and company lots were returned to their places every Saturday, so that the men began every week clad throughout in clean garments. Of course, pains were taken to provide for all bathing opportunities also.

CHAPTER IV.

It was early in June of this year, 1914, when, by order of the war department, the camp and city building in the Uintah district was given the name of Fort Goodwill.

Even at that early date work on the city site was well under way. When we think of the many great works that were going on at the same time during this, which was afterward known as the hurry season, we should remember, not only the great number of workmen employed, but the fact that in all the various enterprises in which they were engaged the work was done by the most effective machinery applicable where earth was to be removed or excavated there were no teams or wagons, and but very few shovels employed, but great steam shovels, plows and scrapers lifted and loosened the earth, while strong steel cables, stretched on wooden supports overhead, were the roads along which great carriers ran to and fro loaded with tons of earth at a time to convey it to the place where it was desired to deposit it. Where rock was to be removed, power drills cut down quickly, and the rock was loosened and lifted in great blocks, as it is in quarries, to be afterwards applied to any purpose for which it was best adapted.

In preparation for building the city the ground had been platted on a double system of streets and avenues. The primary system has already been mentioned as consisting of four main avenues intersecting each other at the site chosen for the city center, one running north and south, another east and west, and the other two bisecting the quadrants. At the point of intersection of these avenues it was intended ultimately to place a grand public edifice, and the avenues radiating from


Environs of Fort Goodwill.
Eastern Ave.
Fort Goodwill City
Meridian Ave.
S.E. Ave.
S.W. Ave.
Orchard
Canal and R.R.
Forest
Green River Canyon
Agricultural Lands
Industrial Dist.
Western Ave.
Dairy
Storage Reservoir
Uintah River Canyon

this center were considered and named as eight, thus: Beginning with the one running north, North Meridian avenue, North East avenue, Eastern avenue, South East avenue, South Meridian avenue, South West avenue, Western avenue, and North West avenue. To these, as a part of the primary system, must be added the Park Front avenue. This lies in a broken line generally parallel to the terrace slope that borders the city plateau, but descending at its western end obliquely to join the continuation of the Western avenue on the level of the industrial district below. This avenue marks the border of the city proper, being platted for buildings on the north side only, while the south side facing the hill slope was reserved for park purposes. Attention is called thus particularly to this avenue, because it marks the line of the main intercepting sewer and subway, the construction of which was the primary work after the survey preparatory to building the city.

Superimposed on this primary system of avenues is the secondary system, dividing the city into blocks each one-half mile square by streets running north and south and east and west.

As soon as the survey was thus far completed and grades established, men and machinery were employed in constructing the subway and sewer system. This was done by opening trenches along the Park Front avenue, and, opening into this, along each of the streets of the secondary system running north and south. Each such trench was made deep enough and wide enough to build the required sewer in the bottom of it and floor it over, and to wall up the sides with masonry in a substantial manner, and to deck over the chasm on steel arches to support the pavement of the street, thus forming a subway ample to accommodate all water pipes, gas pipes, electrical conductors,

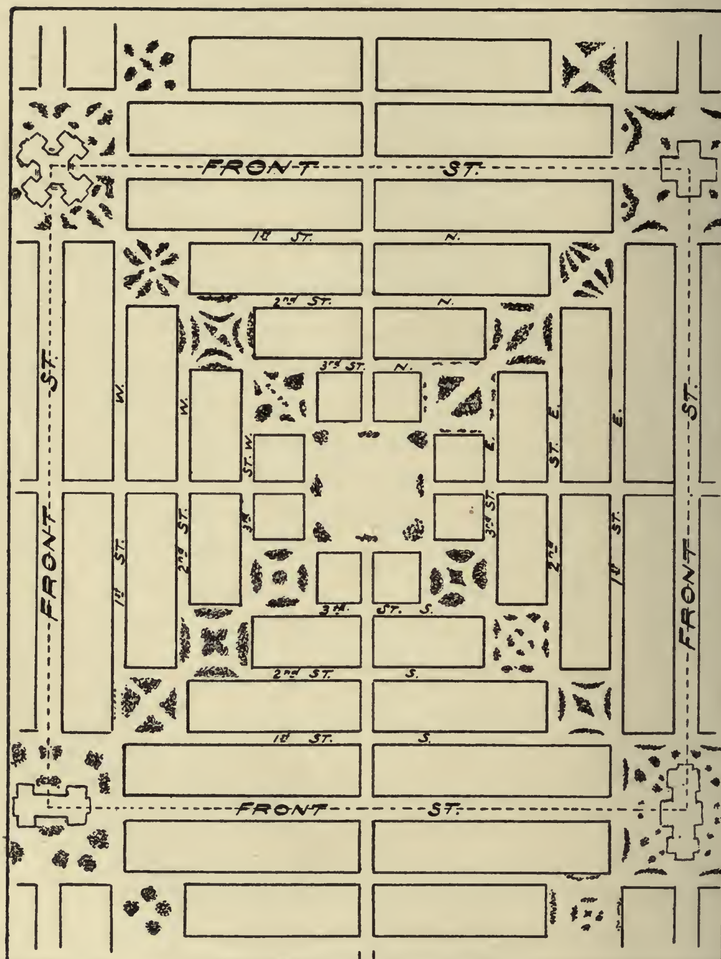
and other conduits which might afterwards be needed, and room enough for passage besides.

The walls of these subways were built with arches for the openings of the secondary subways and sewers afterwards to be built, but those already mentioned being sufficient for the needs of the first season, the construction of this secondary system was deferred until wanted.

The earth removed from these trenches was carried by elevated cableways, such as have been described, to the low places and used in grading up the adjacent blocks.

About the time that the surveyors began the work of laying out the city of Fort Goodwill, an advertisement was published inviting architects to submit plans for public buildings, each to consist of three stories and basement, such buildings being designed to serve, in the upper stories, as lecture halls, libraries and reading rooms; in the second stories as public parlors and school rooms, and on the ground floor as dining rooms, with kitchens and other accessories in the basements. These buildings to be of dignified and appropriate architecture; to be provided with steam heat, water, gas and electric services, with boiler and power rooms placed beneath the level of the ground external to the buildings and opening into the basements. Gas to be used for fuel. These buildings to be fitted temporarily each to serve as an habitation for 1,000 to 1,200 men.

Of such buildings the advertisement stated that it was designed to erect during the present season in Fort Goodwill from 75 to 100; that uniformity of design and appearance in these buildings was not desired, and that, therefore, an architect submitting a design of merit might reasonably hope for its acceptance; that any architect whose design was accepted would be employed to superintend the erection of the building,



MODEL BLOCK.
½ Mile square.

and that he might, if he wished, expect to be retained in the service of the government for similar employment during a series of years afterward. Finally it was stipulated that all designs for such buildings must be submitted before the 20th day of July next.

In completing the plan adopted for laying out the city of Fort Goodwill, while latitude was allowed for variation to adapt each individual block to special circumstances, a normal type of block was chosen in the beginning, according to the accompanying plan.

This normal block was laid out thus: Each of its four sides, half a mile, or 2,640 feet in length, was divided into ten equal parts of 264 feet each. From these points of division lines were drawn parallel to each of the four sides of the block, thus dividing it into strips of equal width parallel to its four sides, each strip, counting from the outside toward the center of the block, being shortened to avoid crossing the strips on the adjacent sides in the course external to it. Each corner, on which strips of the same number from the border of the block cross each other, was reserved for common use. From each of these strips on its outer edge 50 feet was set off for street purposes; two of these 50 foot strips falling together on the borders of two adjoining blocks constitute the secondary system of streets already mentioned. At the corners of each such block the squares formed by the crossing of the external strips on the sides of each of the four blocks meeting at such corners, together with the 50 feet corresponding to the width of the first internal street, forms a square reserved for public purposes, each side of which measures 628 feet. The centers of each of these squares were the sites chosen for the public buildings contemplated in the advertisement before cited.

The 50 foot strips internal to each block being designed to serve as parkways between lines of residence lots without fences, on which the houses were to stand well back, were of ample width. To complete the system of internal thoroughfares in each such block, other 50 foot strips were laid out through the center of the block, parallel to the sides, dividing the block into quarters and bisecting each residence strip, while the squares reserved to the public overlapping each other along the diagonal lines furnished ample space for roadways there. Thus within a very short distance from any point in the city a thoroughfare was provided along a straight line to very near any other point, with no acute angles to turn, while the building lots were all right angled and square with the world.

The portion of each such block remaining on which to build houses consisted of strips each 214 feet wide, affording ample space for houses fronting each side of each street or parkway, with space enough for lawns, trees and flowers about each house. The entire model block provides such space for about 600 residences, which, if occupied each by a normal sized family of five, would give a total population of three thousand on each such block of half a mile square; the central sections were left open in each block to form a public park or playground, 528 feet in extent on each side.

In working out this plan the public buildings placed on the corner squares as described would, of course, terminate the vista on all the streets forming the divisions between the blocks. Where such streets or corners coincided with the main avenues of the primary system, however, the public buildings were set on one side and the plan of the block modified accordingly, these main avenues being designed to be clear throughout their entire extent, with the exception of the great city hall at their intersection in the center of the city.

About this intersection a quarter of each of the four adjacent blocks was reserved without buildings, for park purposes, thus making a central park about the city hall half a mile square.

The borders of all the streets and avenues, together with the central squares in the blocks and the squares reserved for common use along the diagonals of the blocks, were turned over to the charge of the board of forestry and lanscape gardening for ornamentation, with the provision that the central square of each block, while to be planted with a sufficient number of trees, was to be especially fitted as a playground for children.

To designate locations throughout the entire city these blocks are numbered north and south from eastern and western avenues, and east and west from the meridian avenues, just as the United States survey designates townships by their number and range north and south of a given base line and east and west from a primary meridian, and in the central square of each block is a sign marked with the meridian and range numbers of the block. To locate individual houses in each such block, the streets are numbered front, first, second and third streets east, west, north, and south, counting from the outside toward the center, so that an individual address might be, John Smith, No. 14 Second St. North, Block 3 South 2 West, Fort Goodwill, Utah.

To make Fort Goodwill tenable through the coming winter it was necessary that the public buildings on the corner squares should be substantially completed and furnished with their temporary fittings as barracks; also that the waterworks and the sewers and subways should be so far completed as to connect with these buildings, also, since gas was to be the fuel used in these buildings, that the gas works must be com-

pleted, and gas pipes as well as water pipes laid in the subways to connect with them, and all the works were pushed vigorously forward.

The plans for the buildings had been sent in in such numbers and excellence that nothing further could be desired in the assortment from which to choose, and the required number had been accepted and assigned each to its proper location, and work was in progress on them by the first of August. By the first of October the roofs were on them, and, since much of the inside finishing was intentionally deferred until they could be devoted to their ultimate uses, there was no difficulty in making the needful preparations for the coming winter so far as these buildings were concerned. And a strange looking place they made of Fort Goodwill. Eighty odd noble edifices standing half a mile apart in a treeless desert, the plain surrounding them giving evidence of having recently been torn up with trenches which were now mostly covered in, but with nothing but themselves in sight to relieve their solitary greatness.

For the water works the high reservoir on the north fork of the Uintah furnished an ideal source of supply. It was finished and filled about the middle of August. The mains to conduct the water to the city were laid before that time, but as there was three thousand feet of fall between that reservoir and the city it was necessary to construct several intervening reservoirs into which the water could be conducted from one to the other to moderate the pressure. A system of automatic valve gates, controlled by floats in buildings connected with each intermediate reservoir, prevented overflow or waste. It was necessary to house all such apparatus in order to prevent its freezing up in winter.

The last of these reservoirs, which determines the pressure in the city, was placed at an elevation of 150 feet above the

highest point to be built upon. On reaching the city it was necessary to construct for the water pipes a girdling subway about the north or mountain border similar to that on the Park Front avenue, though smaller, in order to connect with the upper ends of the subways on the north and south streets. This was done, the pipes were laid and the water turned on as soon as the water in the high reservoir was ready; before that time, in order to supply the water needed for the building operations in progress, and for the camp, a temporary system of pipes laid on the surface and connected with the north fork of the Uintah at the nearest point where the elevation was sufficient had answered every need.

The gas works, being designed to furnish fuel for the whole city permanently, were made on a scale proportioned to the probable demand on them. They too were ready with every perfection that science and art could give them, the pipes were laid and tested, and the tanks filled with gas ready to turn on in each building as soon as it was completed. It had been ascertained beyond the possibility of a doubt that fuel for all the needs of the city could thus be supplied in the form of gas with the consumption of much less coal than would be needed if it were to be burned in individual furnaces and fireplaces, besides doing away with the labor and dirt inseparable from distributing the coal about the city and collecting the ashes, and also preventing the smoke in the atmosphere and the grime on everything which that ancient, wasteful and unclean mode of consuming coal would necessitate; all of this the use of gas for fuel entirely obviated. It was not found desirable to convert all the carbon of the coal into gas, the coke produced being needed in the iron works. There were other by products, also, some of them chemicals of great value, all of which found

their place and use in the system of works of which these formed a part.

To correct the treeless dreariness of this region, a board of forestry had been appointed early in the season, and to this board all suitable land lying in the bottom of the Green river canyon within twenty miles of Fort Goodwill, about three thousand acres, had been assigned for nurseries. This land being sheltered by the rocky walls of the canyon and easily watered from the river, was admirably adapted for that use, and there, as the proper season arrived, under conditions suited to the needs of each, the seeds were sown from which the following year millions of forest trees would spring, of every kind, useful or ornamental, that could be made to thrive in this region. These trees, however, could not be ready for planting for several years, and for the immediate vicinity of buildings arrangements were made with nurseries in various parts of the United States for trees suitable for planting in the coming spring.

When, early in the season, the railways connecting Fort Goodwill with the iron mines and the coal mines and the world at large, had been completed, the force that had been employed in their construction was distributed along a line parallel with the Green River canyon to near its junction with that of the Grand river to build a railway there. Because of the necessity of opening the way continuously to near the site of operations of the remotest force employed in this enterprise, the work of pushing a railroad through the desert could not be conducted along the whole line at once, but was necessarily made progressive; however, the distribution of force was sufficiently extensive, and the machinery employed so effective that progress was very rapid.

After following the direction of the Green river for about 120 miles, this line of railway was turned westward and continued along a course winding west and southwest through the wilds and deserts of the Wahsatch range and thence southwestward across the deserts of southern Nevada toward the California line.

It will be remembered that the 400,000 men employed during this season in the Fort Goodwill region had left more than 100,000 men for service elsewhere, of whose employment nothing has yet been said. This division had been sent to southern California and their headquarters established at San Bernardino. About 20,000 men of this division had been organized into a railroad building force and employed in pushing a railway north and northeast, across the great Mohave desert, and on over the southern part of the Sierra Nevada range across the Nevada line. This line of road effected a junction with that coming down from Fort Goodwill about the middle of October, and the line was open from Fort Goodwill to San Bernardino. The completion of this line of road during this season was very important because the buildings going up in Fort Goodwill could accommodate properly but little more than 85,000 men during the coming winter, and the winters there were severe. It was necessary, therefore, before the season closed, to remove the 320,000 and more in excess of that 85,000 men out of that region into a warmer climate, and it was intended to take them to southern California.

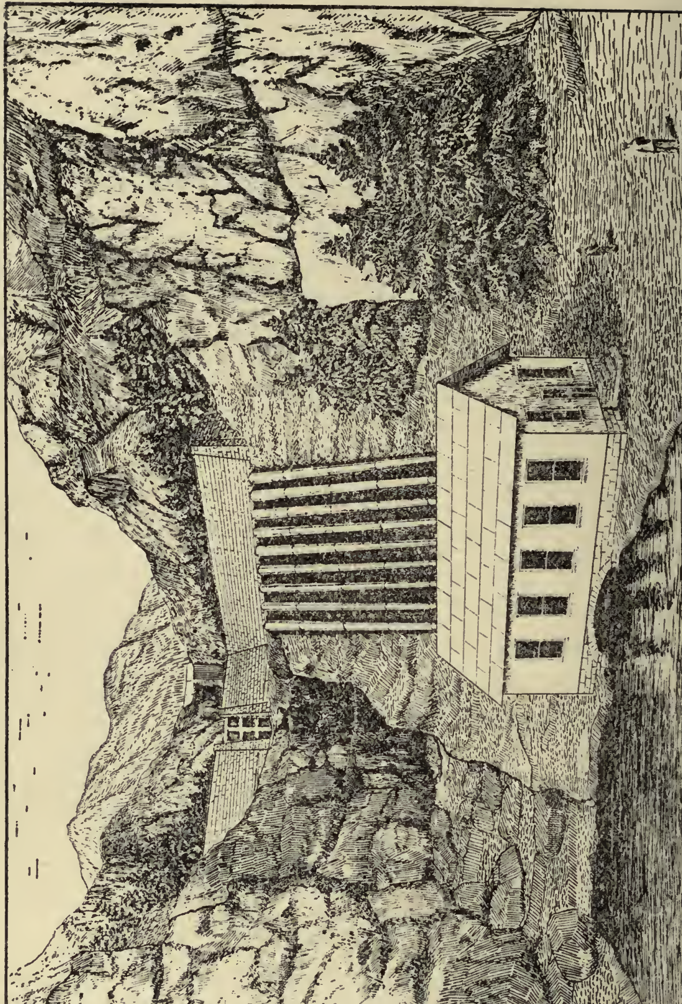
CHAPTER V.

In none of the works in and about Fort Goodwill was it intended to use steam as a permanent source of power. The location, with 3,500 feet head of water in one river close by, with 500 feet head on another, with other streams of considerable size pouring down from mountain heights not far away, is an ideal one for the development of water power.

Away back in the '80s, a very effective water wheel was invented, for use on small streams furnishing a high head of water. This was especially well adapted for the development of electric power from mountain streams, and it was first extensively used for that purpose in the Sierra Nevada mountains in California where it was perfected and generally applied to that use in the early nineties.

Long ago in the olden time, before the steam engine was invented, when water power was the power of the world, the saying became a proverb, "You can not grind with water that is past." All through the reign of the steam engine that saying remained true, and because water power had to be used where nature placed it and could not be had where it was wanted, it fell into disuse and the steam engine became the world's source of power. But when electric power was discovered, and the dynamo was invented, this old proverb became no longer true.

You can grind with water that is past; you can grind with water that has not yet come to your mill; when it pours down from mountain heights you can grind with the same water used over and over again; you can grind with water that isn't coming by the way of your mill at all; you can grind anywhere with water anywhere else within twenty-five or thirty miles of



A Power Station in the Uintah M'ts.

your mill or even farther, hence water power is resuming its ancient place and the steam engine is falling to the rear.

As a permanent source of power for this region, in addition to the two main forks of the Uintah which have been mentioned, all other tributaries of the Uintah and the Green rivers within twenty miles of Fort Goodwill, of which there are many, were followed up and fitted with power stations suited to the size of the stream.

These power stations are made by building across the bed of the stream at the head of each slope a strong dam of stone, making a pond on the stream above, which reaches to the foot of the next slope and the power station above. Each such dam is fitted with a flood gate opening it to the bottom, to be opened in times of storms and freshets in order that the stones and earth washed down by the rains and melting snows may pass on and not be deposited in the basins above the dams. From a discharge flume, into which the water flows freely from this pond, a series of iron pipes are placed side by side, the united capacity of which is sufficient to carry a volume of water as great as is thought desirable to use, which, of course, from ponded waters like these is by no means limited to the volume of the stream. This series of pipes is termed the battery; each pipe extends from the flume above to the foot of the slope, and each pipe tapers from the top to the bottom to fit the diminishing volume of the stream caused by its increase of velocity as it falls. At the foot of each such pipe is placed a water wheel and each wheel is connected with a dynamo, pipe, wheel and dynamo in each case being of a capacity suited to each other, and the whole properly housed. Arranged in this manner, it is easy to use as many or as few of the dynamos as may be needed to produce the required power at any time, while, on small streams, the ponding waters above reserve all the power not in

use at any time, for use when wanted later, and waste is avoided. By this multiple system of flumes, wheels and dynamos, and the reservoirs at the head of each battery, each station can, if needed, for a time be pushed up to its maximum capacity at any stage of the water, and the power available is immense. When, in the winter, these mountain ravines are blocked with snow and inaccessible, power is not needed for agricultural operations, and the stations on the larger streams are more than sufficient for all requirements, then the flood gates in the dams on these mountain streams are thrown open, the machinery in the power houses is oiled and covered with canvas, and the stations are closed for the season.

While all these preparations were going on in the mountains, on the city site and on the desert plains, the work on the wheat lands had been pushing forward with no less energy. All the sage brush and other encumbering growths had been grubbed out and carried away, surface stones had been removed, and such rocks as could not be removed were located and marked. The pipe lines, power shafts, pulleys and wire cables, with shifting apparatus to remove the pulleys and cables from place to place, as the moving machinery on the land might require, were all completed and properly housed; reversible gang plows made very strong, for lightness was not necessary, one to every half mile, were waiting in the power sheds, while seed drills and grain to complete the sowing stood in readiness to follow the plows. The hose pipes were coiled in the sheds, a quarter of a mile of it to each plug, once in three hundred feet. The reservoirs, the canal and the aqueduct were full of water; the irrigating force had been drilled in the service required of them, and, on the 15th day of September, 1914, everything was in readiness to turn the water on the land.

At 8 a. m. of that date an electric car ran down the tracks on every section of land to be irrigated and left three men at each hose plug. At the signal each of these section parties began laying and coupling the hose, the men on the even numbered sections laying it forward across the track, and those on the odd numbers passing through the sheds and laying the hose from the back to meet the men on the opposite side of the section. Each party of three continued laying the hose until two-thirds of it had been connected, then one of each party went back to turn on the water while his companions completed laying the hose, similar parties from each side of the field meeting in the center. Then at a signal the man who had gone back turned on the water and returned to assist in handling the hose at the center of the field. At the end of each line of hose one man handled the distributor, which is quite the opposite kind of contrivance from a fire nozzle, consisting of a sort of broad-wheeled push cart, into which the hose discharged against a board designed to spread the stream and from which the water flows quietly in a copious stream over a board that runs close to the ground. To begin operations the two distributors from the opposite sides of the field are placed side by side at the farthest side of their 300 foot section. When, all being ready, the signal is given to the man at the plug to turn on the water, in less than a minute it comes rushing through the hose under the pressure of 50 feet head more or less and begins to pour out of the distributors. Then the men handling the distributors slowly back side by side across the section while the water overflows the land to the depth of an inch or more, pouring off on either side over the thirsty earth which rapidly absorbs it. On reaching the near side of the section where the earth is wet from the next line of hose, the distributors are turned, and again backed across a few feet nearer

the pipe line from which the water comes than their first path across the section. This they repeat again and again, uncoupling the sections of hose and leaving them on the ground as they reach the couplings. They leave the earth behind them, on this occasion, saturated with water enough to have covered it to the depth of two or three inches, for this first full drink the thirsty earth has had for unnumbered ages needs to be a great one, hence two days were consumed in watering the sections to the edges of the field. And no sooner was this accomplished than the hose was recoupled and the task repeated. This time, however, the sections were covered in one day, and the hose was coiled on its truck and carried along toward the power sheds as fast as it was discarded. It was now the 18th day of September, and every alternate section of the hundred and odd square miles of land was ready for the plow.

The hose was now shifted to the opposite sides of the power sheds and the remaining sections were irrigated in the same manner as the first had been. This method of irrigation was adopted for the first utilization of the land as best adapted to apply the water, in such quantity as might be desired, evenly to a large body of land not yet prepared for the method chosen for permanent use. Afterward the land was fitted at leisure for subsurface irrigation from pipes of porous tile laid in the subsoil, and, this arrangement once perfected, the land can be watered to exactly the degree desired without a man or a wheel going over its surface, while that surface remains loose and porous as when fresh from the plow.

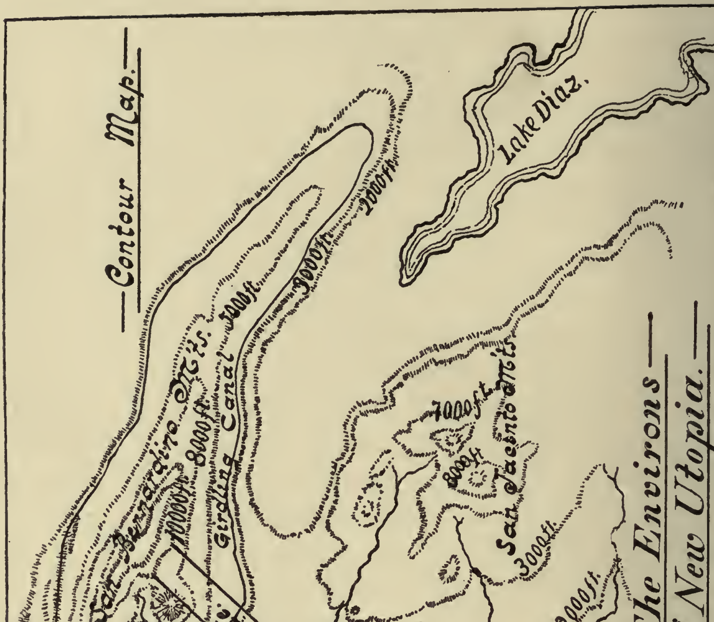
On the fields thus made ready the wire cables were now connected over pulleys on the opposite sides of the field and the gang plows attached, one for every half mile along the power shafts. Better to distribute the strain, the power was applied at both sides of the field and the plow started, turning

a belt of earth behind it eight feet six inches wide. The first time across the plow moved at the quiet rate of three miles per hour, taking ten minutes to cross the field, then the plow was reversed to throw the furrows in the same direction as the preceding and the cable was speeded up to six miles per hour, carrying the plow across the field in five minutes. At this rate of motion the earth flew from the mould boards of the plow as water flies from the bows of a rapidly moving steamer, pulverizing it completely and spreading it perfectly level, thus making a far better seed bed than it would have been possible to produce with plows and harrows moved by horses. No harrowing was needed. Each plow turned the earth at the rate of six acres per hour. After the plows had gained an hour's start the seed drills were started after them covering twice as much ground at a trip, but moving only half as fast as the plows, and five days after the plows were started the alternate sections first entered upon were sown with wheat throughout their entire extent.

Meanwhile the other sections had been watered and were ready for the plow. Shifting the machinery to the opposite sides of the power sheds, these alternate sections were plowed and sown in like manner, the whole being completed before the first day of October; and never before, since the mountains round about had been carved out of the earth, had their arid foot plains smiled with such verdure as covered them two weeks later. But the subsoil and the rocks were thirsty, and, that the growth of the young plants might not be checked until the snows of winter should cover them, the fields of wheat were gently irrigated again during the last week of October.

CHAPTER VI.

Southern California was extremely arid. Including its mountains, plateaus, and valleys, in its natural state not enough water fell on it to support life on more than one-tenth of its surface. At this time, 1914, that water had for thirty years and more been used with the utmost economy. The streams which in the rainy season flowed down from the mountains had been dammed and their waters collected to give life to the parched earth through the long dry season; but, do what you will, more water can not be collected in a country, nor pumped out of it, than falls on its surface, nor so much. Artesian wells had been sunk where ever water could be reached by them, and their outflow was used to irrigate small orange groves and vineyards, all of which lay between the San Bernardino range and the sea, but all the irrigated lands of the region taken together amounted to but a few oases in the desert. North and east of the San Bernardino range, to the Nevada State line and the Colorado river, spread the great Mohave desert, 120 miles and more toward the north, and 100 miles to the eastward, too dry for any green thing to grow there, not even a cactus except in favored spots. Southern California for 300 miles measured parallel to the ocean, and 200 miles wide, as a whole remained a desert. In the heart of this region, the culminating height of the whole country, the great San Bernardino range towers to a height of 12,500 feet. Separated from this by an arid plain from ten to twenty miles wide, are the San Jacinto mountains, a rugged and irregular group constituting the southern part of the coast range, and covering the greater part of the country north of the Mexican boundary between


Contour Map.
The Environs of New Utopia.
Lake Diaz.
San Bernardino Mts.
Girdling Canal
San Jacinto Mts.
New Utopia
San Bernardino
Pacific Ocean.
10000 ft.
8000 ft.
5000 ft.
3000 ft.
2000 ft.
7000 ft.
3000 ft.
2000 ft.
1000 ft.

the San Bernardino range and the ocean. This group reaches the respectable altitude of 8,000 feet. To the west and northwest of this mountain group lies the valley of the Santa Margarita river, averaging about twelve miles wide and extending directly up from the coast to the foot of a slope leading directly up to the highest part of the San Bernardino range. This Santa Margarita river, like all other streams in this region, flowed during the rainy season but at other times was a dry bed only. It takes its rise in the San Jacinto mountains, bearing the name in the upper part of its course of the San Jacinto river, and flowing for the first thirty-five miles in a nearly straight line northwest. Here it turns a right angle and flows a little more than twenty miles southwest, along the course of the valley above described, taking the name of Santa Margarita at this elbow. At the point reached in this twenty miles of southwestward course, the Santa Margarita again turns a right angle toward the southeast, flowing fifteen miles in that direction to the foot of the San Jacinto mountains again, and then turning once more toward the southwest in a direct course of twenty-three miles it reaches the sea.

The upper three reaches of this river bed, as will be seen, bound three sides of a rectangle, the greater part of which is occupied by a plateau lying above the height of 2,000 feet, which constitutes a sort of buttress on the northwest flank of the San Jacinto mountains.

The first measure taken in this region, except the topographical survey, had been to extinguish, under the law of eminent domain, all private titles in the San Jacinto mountains above the contour line of 2,000 feet, and also throughout a broad tract along the Santa Margarita valley from the Pacific coast up to the heights of the San Bernardino range and in the territory intervening between this belt and the mountain tract

of San Jacinto. To this region, in the early spring of 1914, that portion of the army not needed for the operations about Fort Goodwill had been taken, numbering about 120,000 men.

The first work to which they were set was to construct a system of self-filtering reservoirs in every ravine and valley throughout the San Jacinto group, of such capacity as, according to previous observations, the rainy season might be expected to fill.

In this work, distributed in such manner as they could be used to best advantage, about 80,000 men were employed, some in excavating and preparing beds for the reservoirs, some in quarrying stone with which to build them, some in preparing lime and cement for use in their construction, some in constructing tramways and inclined plane elevators, and some in building the works proper. The filtering arrangement consists of stone culverts or tunnels laid in the bottom of each ravine above the reservoirs which they were to feed. These were built with small openings everywhere in their tops and sides. Over these tunnels the ravines were filled to the depth of several feet with loose broken stone and gravel, such material as constitutes the debris which, during heavy rains, washes down the sides of mountains until often the torrent which at such times pours down the ravines consists as much of stones and gravel as of water. Such debris forms the beds of all dry stream channels which in semi-arid and mountainous regions form the natural roadways. This loose material was retained in place in steep ravines and valleys by walls of solid masonry based on the bedrock and built across the ravines wherever needed, of sufficient height and strength to prevent the danger of landslides down their course. Over the foot of each tunnel the massive upper wall of a reservoir was built with the tunnel opening through it. These reservoirs were built of cut

stone laid in cement, and carried to such a height as to be above the reach of overflow in any possible floods, overflow channels being constructed around the sides of the reservoirs, of course. Many of these reservoirs, where the bed of the ravine was too steep to admit of sufficient capacity in a single basin, were compound, consisting of a series of such basins, the water from the upper one flowing through a pipe into the one next below, and so on through the series.

From this San Jacinto mountain area above the 2,000 feet contour line all cattle, sheep, and other herbivorous and browsing animals were rigidly excluded, and every precaution was taken to guard against the starting of fires in the dry herbage which accumulated. In this manner the growth of all trees and shrubs was protected and the mountains, better clothed with vegetation, retained more of the moisture that fell on them and therefore became cooler and a better condenser of atmospheric moisture, and, within a very few years, the annual precipitation upon them was greatly increased.

About the border of the plateau previously mentioned as buttressing the San Jacinto mountains on their northwestern face, and lying in the rectangle outlined by the three upper reaches of the Santa Margarita river, starting a little above the 2,000 feet contour line at the southern angle of that plateau and following that line closely, allowing a descent of about six feet in a mile toward the north and northwest, a great subway was begun this season, with a sewer in its bottom, similar to that about the Park Avenue border of Fort Goodwill. This was the first work showing that this plateau was chosen to be the site of a city, it being so located and constructed that it would naturally receive the outfall of any and all such conduits that might afterward be built on the plateau above. This conduit, though at the bottom of a spacious subway through nearly

its whole extent, was in several places carried over ravines on stone arches. It was built in a leisurely manner, under the labor of a small force, and it was three years before it was completed. It terminated finally in the ravine of the San Jacinto river north of the plateau, where a small receiving basin and a pumping station were afterward constructed to receive its outflow and lift it on the way to a more distant destination.

Another work begun in the San Jacinto mountains very early this first season was the quarries. Through the greater part of the western and northern portion of this group the rocks of which these mountains consist lie in horizontal strata, and from about the 3,000 feet level, where the plateau set apart for a town-site breaks into the steeper heights of the mountains above, this rock consists of an excellent, hard, nearly white quartz standstone, in a formation nearly three hundred feet thick. The individual strata of this vary from one foot to ten feet in thickness. This rock, like many sandstones, hardens by exposure to the atmosphere, and for quarrying and building purposes nothing could be finer.

In the face of this deposit, on the same level, at intervals of about a mile, avoiding points where the line of the work would intersect ravines, six quarry faces were opened. But the work was not conducted as quarrymen usually work, in an open pit, regardless of the unsightly gash which they make in the earth. The base selected for operations was a stratum just above the 3,000 feet contour line. The quarrymen began work in the stratum which reached the height of sixty feet above this base. From this stratum they removed a section across a space of twenty feet above a center of the part chosen for excavation. The next stratum underlying this was removed to a width extending as much beyond this first on either side as equaled the thickness of the stratum. Below this, the next

stratum was removed in the same manner, still extending beyond the portion removed from the stratum above to a width equal to its own thickness, and so on, until the quarry face widened from twenty feet in width at the top to sixty feet at the level twenty feet below. From this point with vertical walls through the remaining forty feet of depth to the floor plane this width of sixty feet was maintained, so that each working face had the dimensions of sixty feet both in height and width. This form and size was maintained continuously, the upper strata being excavated in advance so that each face was kept in the form of a stairway. Each of these quarry faces was pushed forward like a tunnel directly eastward into the body of the mountain, as many men being employed on each face as could, with their compressed air drills and other machinery, work to advantage.

In each of these openings, as soon as the mountain had been penetrated far enough so that a cross tunnel would not approach the surface, other working faces exactly similar to the first were started toward the right and left, and a similar gallery was pushed in each direction at right angles to the first. This afforded space for three times the force employed at first, and allowed an output of three times as much stone in a given time. Beyond the first cross gallery, at distances of 120 feet, so that each sixty feet wide working face alternated with sixty feet of the unbroken rock, other cross galleries were opened, and on each of the cross galleries, as fast as they were extended to a sufficient distance from the original tunnel, other galleries of the same size and spacing were opened parallel with the first. Tramways for removing the stone and for advancing portable cranes for handling it were, of course, pushed forward in each gallery as fast as the working face advanced, and the working

space available soon far exceeded what could have been utilized on the open quarry plan.

With the working space available, the working force employed in these quarries was increased, until before the end of the year, some 24,000 men, in three shifts of 8,000 each, working eight hours at a shift, were working day and night in excavating and removing the stone, and the excavated space was growing into a system of catacombs of grand proportions.

Among things demanding attention in this vicinity during this first summer of the industrial military service, it was necessary to provide camps and barracks suitable for the accommodation of the main body of the army which was to be brought here for the ensuing winter. The work required to effect this, however, was little compared with what would have been necessary to the same end in Fort Goodwill.

Several villages existed in the tract appropriated to government uses and these, with the addition of structures suitable for the general utilities of the army, such as the cooking and laundry departments, were with slight alterations made available for housing the army.

The new water works system, in the San Jacinto mountains, was ready to yield a more than ample supply of that indispensable fluid, and before the advent of the main body of the army in November everything was in readiness for its comfort.

The forces in this division of the army during this season, who were not employed in the works already described, nor on the force engaged in pushing the railway across the desert to meet that coming down from Fort Goodwill, were employed in grading and excavating on the belt of territory appropriated by the government in the valley of the Santa Margarita. Here with the most powerful machinery they were leveling ridges

and filling valleys. Great ridges and crests of rock were blasted off and lowered to the depth of hundreds of feet, and their substance thrown into ravines and hollows, but a peculiar feature of all this work was that, at intervals of a quarter of a mile apart, strips of excavations longitudinal to the belt of territory covered by these works were made down to the bed rock and left open, unless, where the grading had been done on such strips, the denuded rock reached the surface.

These denuded places were shaped into beds suitable to receive the bases of towers or piers of cut stone, and to the margins of these excavations the stone was taken from the great quarries in the San Jacinto mountains. To extending this grading, and building the piers in these excavations, the main body of the army was applied as the men arrived in November, and this work was pushed unremittingly all winter. Spread as it was over many square miles of territory, while it was evidently in strict accordance with a carefully prepared plan, what the ultimate purpose of it all might be was to the world an unfathomable mystery; so far as the general public could understand, it appeared to be without purpose. This work served, however, as a sort of reservoir of employment that could receive additions of force without limit and from which forces might be withdrawn for other purposes to any extent without damage to what had been already done and without crippling the efficiency of those that remained.

The hours of duty and the mode of life of the men employed, here as elsewhere, in all branches of the service, were arranged with due regard to the comfort and improvement of the men employed. Eight hours was the limit of the day's work, and during the greater part of the time the hour of instruction in the form of lectures, which every man was required to attend, was taken out of this eight hours of daily duty, though it was impressed on the men that this was a favor to be withdrawn whenever the good of the service required the full eight hours of constructive labor.

CHAPTER VII.

At Fort Goodwill, during the winter of 1914-1915, the iron works and machine shops, together with all other fixed industries that could be carried on under cover, were operated continuously but deliberately. The forces retained in the great buildings that had been erected during the summer were selected especially with reference to manning these works, but as the pressure of the season's hurry relaxed the stress put on the education and training of the force was increased. The required attendance on lectures was increased from one hour to two per day, and the works were conducted as if their primary purpose had been to serve as a manual and technical training school. Nevertheless, before spring an immense stock of water pipe, and steel shafting, wire cables, machinery, dynamos, and all the special devices required in the new system of agriculture and irrigation had been accumulated, and of structural steel for bridges, every piece made and labeled for its place in the bridge for which it was designed, there was also a great stock. With the return of spring the forces were brought back from the San Jacinto district as fast as required to push the work forward here. One of the first enterprises of the season was to build a great steel bridge across the Green river canyon at a narrow point about twelve miles east and four miles south of Fort Goodwill center. An electric railway was carried across this bridge and across the plain to the foot of the mountains bounding it on the east, and thence southward to the vicinity of the White river canyon where, turning eastward, it continued up this canyon to a point some eighteen miles beyond the Colorado line.

At this point, work was begun to build a great dam of cut stone, designed to raise the water of White river 160 feet above its natural level and form a lake above the dam some twenty-four miles long and from three to ten miles wide. The bed of the river at this point is 5,465 feet above the sea; the canyon there is narrow and the rock hard and solid, making a favorable point for the construction of such a dam. This, when completed, would raise the water to the level of 5,626 feet. From this reservoir, a canal was carried along the foot of the heights down the White River valley and thence northward, with a fall of only two feet per mile, until it reached the Green River canyon at a point near its crossing with the Colorado line. This canal makes the plain lying east of the Green River canyon and north of the White river all available for irrigation; the work required in the construction of the dam, however, was great, and after its completion, if it were hurried to completion in time for the fall sowing, the river would be unable to fill the reservoir in time to make its waters available, hence work was so timed on this as to have it ready for the autumn of the following year.

For the present year it was not intended to sow the fields on which a crop of wheat was now growing, to wheat a second time, and they were needed for another purpose, but the waters of the Uintah and its tributaries were amply sufficient to irrigate 150 square miles of new land in addition to the fields already supplied, and west of the north branch and the main canyon of the Uintah twice that extent of land awaited it. To utilize this, the main canal constructed the preceding year was now continued westward from the storage reservoir along the contour line that would give it a fall not exceeding one and one-half feet per mile, until it crossed the west fork of the Uintah, thence curving southward it crossed Strawberry Creek,

a tributary entering the west fork of the Uintah from the southwest, which was, of course, intercepted and used as a feeder for the canal. From this crossing the contour of the land now made it necessary to carry the canal back in a sweeping curve toward the east, southeast, and south, but before reaching the border of the Green River canyon again more than ten townships, or 360 square miles of land lying below the level of the canal had been included in its sweep and made available for agriculture.

For the present season's uses about twenty square miles of land between the high level canal from the west fork reservoir and the main canal were prepared for plowing in early June, to be planted in potatoes. One hundred and fifty square miles within the bend of the main canal up the valley of the west fork were put in preparation to be sown with wheat. The methods of applying the water to the land, and of moving plows and other machinery by power, were the same as were employed the previous year.

Up the main canal parallel with the canyon of the Green river, northeast from Fort Goodwill, a small force of men with excavating machinery were engaged in extending its channel. In this part of the work there was no hurry, but the electric railway that paralleled the canal was pushed on to the Colorado line, about thirty miles northeast of Fort Goodwill. Here quarrymen and stonecutters, with all the apparatus used in their work, were sent, and a camp was established, and quarries were opened, and the bed rock across the canyon was laid bare and carved into a mortise to receive the foot of a great dam, and the work was begun to build here the greatest dam that had ever been built anywhere up to date. The bed of the river here, at the bottom of the canyon, is close to the 5,000 feet level above the sea.. The level of the water in the canal, 5,462

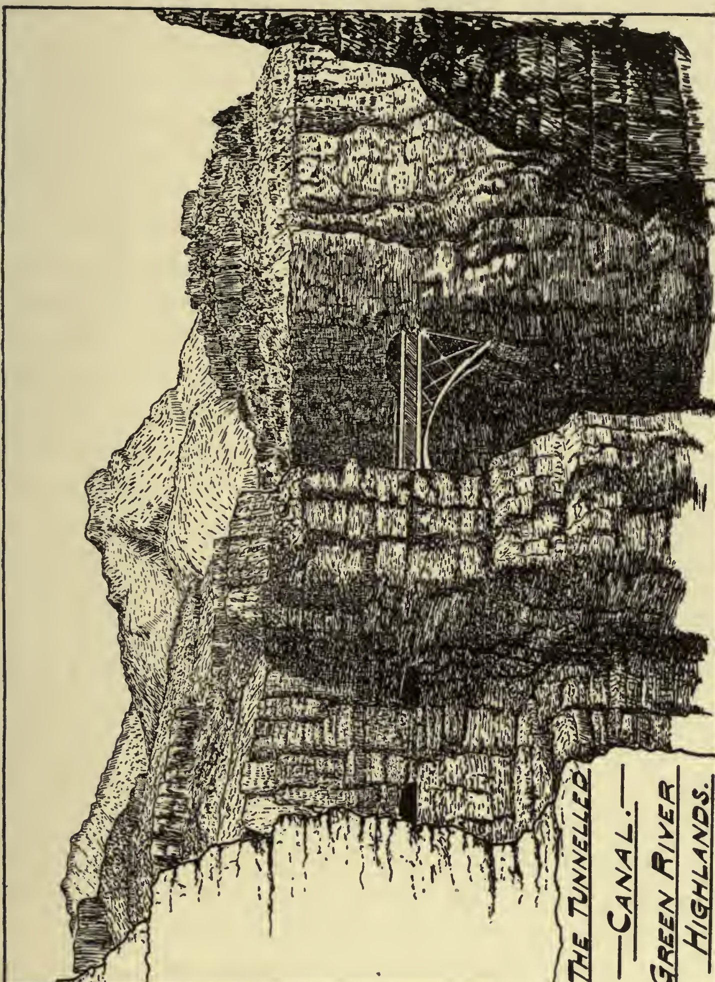
feet at Fort Goodwill, would here need to be about 5,500 feet, and it was the purpose of this dam to lift it to that height. The bed rock of the canyon here is hard and firm, and the total width to be dammed about a mile and a quarter. The work was to be done in a manner to stand forever, and no pains were spared to make it perfect. The height of the dam above the bed of the river was to be 520 feet, the slope of its front 50 degrees. The breadth of masonry from front to back at the bottom, as it lay in the mortise cut in rock, was 430 feet; the rear wall of the stone work was to be vertical and to be filled in behind with a filling of earth, and the level top of the dam to be 20 feet broad. The dam itself sweeps across the canyon in a circular curve on a radius equal to the length of the dam, with its convexity up stream. The slant height of the face of this dam from the channel of the river at its foot to the roadway across its top is nearly 700 feet.

This dam was a work which, as will be seen, would have swallowed the great pyramid of Egypt many times over, and, while it was pressed steadily forward with all the great resources of modern engineering, it was not necessary, neither was it desired, to hasten it unduely, and it was expected to take three or four years in building.

While these works were in progress on the Green river above Fort Goodwill, others were going on below, with the purpose, ultimately, to carry the collected waters to the arid plains farther south where they could be utilized. The land lying south of the return sweep of the main canal from the valley of the west fork of the Uintah toward the Green River canyon rises into a mountain mass reaching above the height of 9,000 feet, filling the space from the Wahsatch mountains clear up to the Green River canyon, while on the opposite side of that canyon a similar elevation comes down from the moun-

tain heights of Colorado in the east to meet it. Between these mountain heights the Green River canyon forms a mere gap. The canyon walls through this region, now known as the Green River highlands, are rugged in the extreme. For long distances they are nearly vertical, often overhanging, broken by projecting promontories and yawning gulfs, with a height varying from 800 to 1,500 feet, while the level of the canal at its entrance of the highlands is 720 feet above the bottom of the canyon, and at its emergence, and point of departure from the canyon, thirty-five miles further down the river, its height is 972 feet above the bed of the river in the canyon. Through this region it was necessary to carry the canal. Wherever the canyon walls sank low in the level of the canal it was, of course, built upon the surface, but for nearly thirty miles out of this thirty-five it was necessary to carry it through a tunnel. This tunnel follows the course of the canyon as nearly as proper curves will permit. It was sought to carry the line of the canal near enough to the canyon walls so that openings could be cut through from the tunnel at frequent intervals to permit the rock removed to be cast out through them into the canyon below. Often, however, the tunneled canal departs widely from the canyon walls to pass some sharp angle, and often it emerges to cross some yawning gulf on an aqueduct built on trussed arches of steel.

This tunneled canal was made to carry a width of sixty feet, and a depth of ten to fourteen feet, with a fall of two feet per mile, the channel being cased in with masonry laid in cement. This canal would not be needed for use until the great dam on the upper Green river was completed, but a sufficient force was put at work on it to keep it in progress night and day from three working faces, the first being at the entrance just south of the Pleasant Valley brook crossing,



THE TUNNELLED —CANAL.— GREEN RIVER HIGHLANDS.

thirty-six miles south of Fort Goodwill, and the other two one on each side of a valley five miles further south. This work was pushed forward continuously by three shifts of men working eight hours each on each face summer and winter. The portion which remained unfinished when, three years later, the great dam drew near completion, was hurried by the opening of a dozen new working faces from the canyon wall and from surface shafts, besides that at the point of exit of the tunnel high above the canyon of Prices river where that stream flows along the south side of the mountain into the Green river from the west. From this point the canal was carried westward along the mountain side twenty-four miles, to conduct the water into a great reservoir formed by damming the valley of Prices river at that point, but this belongs to a later stage of our narrative.

CHAPTER VIII.

Preparatory for the needs of the season of 1915 several new industries were started in the industrial district of Fort Goodwill which, together with those established during the preceding season, were now organized to be operated by the citizen tenantry, the status on which the coal and iron miners had been enlisted from the beginning.

Within two months after the opening of the government coal mines a surplus of coal was produced, beyond the needs of the government industries. This surplus coal served as a basis for all needed exchanges. Among the new industries established at Fort Goodwill was a large woolen mill; with a portion of the surplus coal, or money for which it was sold, wool was purchased in California and Oregon, out of which was manufactured in this mill every class of woolen goods needed for use in the army, and also for all incidental needs of the citizen tenantry; a surplus of such woolen goods as were likely to be called for from the outside world was also produced to be exchanged for other things needed, but no effort was ever made, by advertisement or otherwise, to seek a market for them. All these goods were of a quality far superior to any that had ever been furnished to the army through contractors, and the money expense was nothing at all. The machinery was some of it made in Fort Goodwill, some of it was purchased with coal extracted from the government mines, the operatives themselves were government employees, and the force employed, considering the output, and the number of consumers supplied, was exceedingly small. Machinery did most of the work. A clothing factory was also equipped in which the products of this mill were worked up with other

cloths into garments and other forms needed. Similiarly, provision was made for the manufacture of supplies for all other general needs which it was possible to supply with home manufactured products. Most of these industries were operated with two shifts of eight hours each; such industries, however, as operating the blast furnaces and the Bessemer converters in the iron works, in which it was necessary that work should be continuous, and in which work was especially laborious, were operated in four shifts of six hours each, the six hours of labor in these being held equivalent to the eight hours in the other industries.

The commissary department in Fort Goodwill took on the character of an enormous department store furnishing absolutely everything that might be called for, while the productive industries aimed, as far as possible, to supply every thing required in stock. This description, however, anticipates our narrative by a few months, in that it describes the condition prevailing after a large part of the population consisted of citizen tenantry among whom were women and children in normal proportion, but the early months of 1915 were occupied in bringing the commissary department into the condition described.

With the opening of the season of 1915 all payments in the Fort Goodwill division of the army as well as to the citizen tenantry employed were made in time credits payable in goods. These time credits were for hours and minutes, monetary units not being mentioned on them; they were, however, convertible into money at the option of their holders, money being treated as an article of merchandise in the transaction. The demand for money in exchange for time credits was discouraged, however, by the fact that more goods of any kind could be purchased with the time credits direct than with the money that

could be obtained for them. The money for which time credits could be exchanged exceeded the wages given anywhere in the competitive world for the time covered, so that there was no ground for complaint regarding the sum paid, but yet it was possible, while rating goods at the lowest retail cash prices prevailing anywhere, to make the price of goods in time credits so low that if one turned the time credits into money, and then with the money bought goods at these lowest retail cash prices, there would always be a considerable loss to the purchaser from what could have been bought with the credits direct. In this way it was not difficult to wean both the army and the people from the money habit of mind.

The time credit allowed the citizen tenant employee was two hours per day for eight hours' service, the other six hours being exacted of him as a tax for house rent, board, public services, and other benefits which he received. In those arduous occupations in which six hours constituted the day's work the time credit was still two hours, and the enlisted men in the army received the same credit. In fixing the time value of goods in store all classes of goods were averaged together, those purchased in the markets and those imported from abroad being held equivalent to those exchanged for them, plus the time expended in making the exchanges, and were rated at the value in time of the average time expended in producing or procuring them. When any improvement in method or machinery or resources enabled any kind of goods in use to be produced at a smaller expenditure of time in labor, the time value of every kind of goods in stock was reduced in the same degree by the saving. The purpose of this arrangement was, as rapidly as possible, to adjust matters so that one-fourth of the force employed should provide the consumable wealth needed by the whole, leaving three-fourths for employment on

nonproductive improvements; and so effective were the methods and machinery employed that this one-fourth seemed likely to support the whole in elegance and luxury.

This policy, though eminently satisfactory to the army and the citizen tenantry employed, was far otherwise to the business men of the competitive world, and especially so to the tribe of contractors who had been accustomed to enrich themselves through contracts for providing the army with various needed supplies. They protested, of course, but as the purpose of the nation in adopting this course was primarily to make the army self-supporting, and these gentry were never able to suggest any method by which the army could possibly become self-supporting while the privilege was reserved to them of supplying its needs on contracts to their own enrichment, their protests were unavailng; and when the administration assured them that the government would no longer be conducted for the purpose of enabling them to extract wealth out of the American people they soon gave the matter up and either settled down to live on their former accumulations, or sought other prey; generally the latter, so long as any fields of exploitation remained open to them.

On one occasion a committee of business men sought an interview with General Goodwill to protest against the policy on which military matters were being conducted, on the ground, first: of the great expense of such operations as those in which the army was engaged; and, second, of the interference of these operations with the business that formerly grew out of the necessity of providing for the needs of the army.

To these gentlemen, after they had stated their proposition and made their argument, the General replied as follows: "Gentlemen: You are in error. It is true, great works have

already been done by the army; but they have not, as you seem to imagine, been attended with great expense. On the contrary, the accounts in the war department will show you that the expense of maintaining the army during its first year of industry, with its peace equipment, has been less than that incurred during its last year of idleness with its war equipment, though during that time we have had but one source of income from which we could in part meet the expense of our multiplied needs, and that one source of income we have had but little more than half the year. That source of income has been our coal output. Before this second year of industry is past we will probably be able to produce our own food and clothing and machinery. There are far greater works to be undertaken than any in which we have yet engaged, but they will not cost the American people one cent. It would be very poor generalship that could not, with modern machinery, on a fertile soil, with half the force support the whole; we shall do better than that, and we shall do it from a desert where, by the methods and principles you advocate, men could not live. Labor produces everything, pays everything, and costs nothing but its own product, a very small part of its own product according to fact and custom, though in strict justice it is entitled to the whole.

"From capitalists we have cut loose; we will no longer pay tribute to them nor be limited by them. We have no further use for them nor their money. The army will soon be wholly self-supporting, and its operations will be so ordered that it will be well supported, live a wholesome life, enjoy abundance of all things needed, and all under pleasant conditions. It will provide all these for itself and no one will have a right to complain.

"Evidently, any one who finds his opportunities for his own enrichment cut off by the fact that a great body of men, formerly nonproductive and costly, has now become self-supporting; evidently, whether he has realized the fact or not, such a man has himself been a parasite on the people, enriching himself at the public expense over the shoulders of other and lesser parasites. Gentlemen, the present policy in regard to the army is right, it is wholesome, it tends to the public good. The American people are not blind to its benefits and they approve of it; and to this policy the nation will adhere."

This address was published in all the newspapers, and, becoming known in the army, it kindled among the soldiers a wave of enthusiasm for their general that exceeded anything hitherto experienced. The men began to take an interest and a pleasure in their work unfelt before. Their imagination kept before them pictures ever varying and ever bright of the earth blooming forth in new beauty perfected under their hands, and they experienced a pleasure that can come from nothing else than the consciousness of creating in the universe something which the soul can contemplate and pronounce it good. "Who wouldn't," they were wont to ask, "prefer a world that he could fix up to suit him rather than one that he must take ready made and leave as he finds it?"

CHAPTER IX.

We must again notice the progress made in building the city of Fort Goodwill. At our last survey of the scene the great edifices ultimately designed for nobler uses, but for the present serving as barracks for the men who remained in Fort Goodwill to operate its industries through the winter, were standing half a mile apart, each one alone, while the recently turned up earth over the subways gave a strangely unfinished and raw appearance to the scene.

Through the winter the architects who had designed the edifices erected in 1914 had been busy designing and perfecting tasteful plans for small houses, in each of which the usual kitchen and laundry arrangements were omitted, while bath rooms, gas grates, and heaters, and electric lighting appliances were freely provided in all. The corps of architects working in unison had devised a hundred and more details of beauty for use in building these houses, each of which could be manufactured by wholesale, and which could be combined in innumerable forms to delight the eye, and serve the uses of the people just as the letters of the alphabet can be combined into all the words in the dictionary, and express all thoughts conceivable in the minds of mankind.

A few miles up the Green River canyon a great deposit of beautiful gypsum had been found, and of this plaster of paris was made which was utilized in the manufacture of many of these artistic details. Others were made of terracotta and tile manufactured in a department of the brick works. Hollow brick, grooved on the outside to receive and retain a stucco finish, entered very largely into the structure of these houses,

furnishing not only air spaces to preserve equality of temperature and exclude dampness, but also providing for the construction of ventilating flues in the walls and conduits for the transmission of gas and water pipes and electrical conductors, out of sight and out of the way.

Wood was scarce in this region. If the floors, doors and window cases and sash for the houses to be built here during the season had been of lumber, Utah could have been stripped of her last tree, and then the quantity of lumber which it would have been necessary to purchase from the competitive world would have made the work of building the city very costly. But a process had been perfected of making out of sage brush and other desert growths a sort of wood pulp or papier maché with ideal qualities of nonconductivity to heat, elasticity and durability for flooring, to cover tile supported on iron, and also for casings and doors. In anticipation of this use all the sage brush and other plants which had been removed from the agricultural lands of the preceding year, together with that gathered from the land now being cleared, had been saved. This served as material on which a pulp mill in the industrial district was kept running, and the product, compressed and roasted, combined with gums and resins, gypsum, lime, or clay, was of more service in building Fort Goodwill than forests and saw-mills would have been.

None of the small homes to be built this season were to be more than two stories high; none of them were ugly, and there was variety enough in form and plan to avoid any suggestion of monotony or sameness anywhere. The work undertaken this season was to build houses on the residence allotments on each outside plat of the Fort Goodwill blocks. By referring to the plan of the model block, on page 54, this arrangement will be

understood. This program called for the construction in each complete block of 32x2x4=256 such houses. As the blocks were varied to adapt them to local conditions, the intersections of the avenues and other variations all tending to diminish the number of residences from the full normal complement, they averaged a little more than 200 houses to the block. Work was first begun on the outside rows of houses facing the front streets, but in order to build and complete any house on the plan here followed it was necessary that the sewer and the subway carrying the pipes and conductors supplying the house with water, gas and electricity should be completed also.

On the front streets running north and south, it will be remembered, these subways had been completed the previous year, but those on the east and west front streets, and the secondary subways on the first streets, together with the service ways to the individual houses remained to be constructed. In these subways gas and water pipes and electrical conductors for lighting and telephone service were laid to connect with each house as soon as the subway was completed and work begun on the foundation of the house. The walls and roofs of these first rows of houses facing the front streets were mostly completed and the structures turned over to the finishers by the first of July when the work on the second rows facing the first streets was taken up.

Work was now begun also in preparation for paving the main avenues and the front streets. To this end, the grading was perfected and curb stones were placed to make a roadway on each of the front streets fifty feet wide, leaving twenty-five feet for lawns and shade trees. The roadways were paved with a thick macadam pavement heavily rolled and the surface finished with a dressing of cement, or on some of the streets of asphaltum, making a pavement smooth, hard and strong.

This pavement was, during this season, laid on all the main avenues of the primary system as well as on the front streets separating the blocks, and on Western avenue it was carried to the storage reservoir on the north fork of the Uintah, a distance of about nine miles, while in the opposite direction on Eastern avenue it was continued to the angle on the way and thence to the bridge over the Green River canyon. On the southeast, South Meridian, and Southwestern avenues, the pavement terminated at the main canal, and on the avenues in the opposite directions at the city limits lying at the foot of the mountain slopes.

When the pavements were constructed, the railway tracks, which had hitherto served for the transportation of men and materials, were removed. With rubber tired automobile cars capable of making thirty miles per hour, if desired, no railway tracks in the streets were needed.

At this stage of progress another proclamation was published throughout the United States as follows: "On and after the first day of September next, citizen tenantry will be accepted to people the city of Fort Goodwill, Utah, and other places that may from time to time be fitted for occupation, under the following conditions: First—Any applicant for enrollment in the citizen tenantry of the United States must give evidence of ability to perform some useful part in the public industries, and pass examination in regard to his fitness therefor. Second—He must be a married man, or have minor children requiring him to be an householder. Third—His age must not exceed forty years.

"Positions under this order will be given, first: to any one in the military ranks who can meet the requirements; and, after such are provided for, to others who may best fill some requirement of the public service.

"Examinations of applicants will be held weekly on Tuesdays in the government buildings in all the principal cities throughout the United States. To each accepted citizen tenant the Government will furnish transportation for himself and family to his future residence, a good house for his home, board for himself and his family, schooling for his children, and educational lectures and instruction daily for himself and adult members of his family, together with fuel, water, electric lighting, telephone, and all manner of general services.

"Each adult man accepted under this order, will be required to render service in such public industry as he is qualified for, eight hours per day, or forty-eight hours per week, of which services he will be taxed six hours per day, or thirty-six hours per week, in payment for home, rent, board, and public services rendered to him; for the other two hours per day he will be paid an equivalent for the full product of that two hours service. Each adult woman will be required to work four hours per day, or twenty-four hours per week, in some appropriate occupation to be provided for her, of which three hours per day are to be charged to her in taxes for benefits received, and for one hour per day of which she is to be paid a full equivalent for its productive value.

"Each minor child, after the age of five years, will be required to attend the public schools provided for its education.

"On reaching the age of fifty years each citizen tenant will be retired from the public service on a pension sufficient to provide for his maintenance as long as he may live.

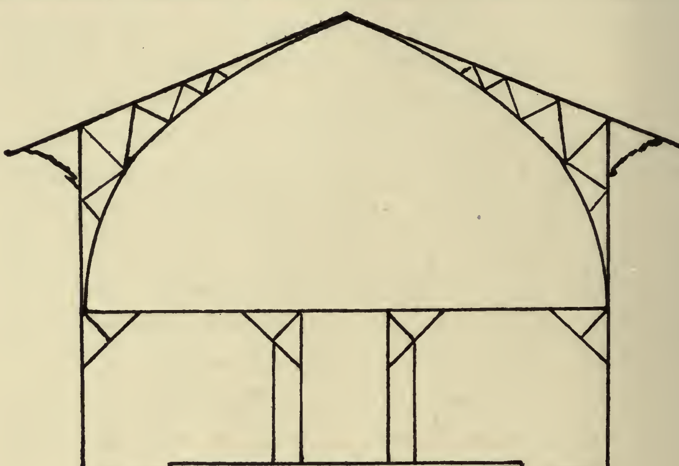
"The citizen tenants will be tenants and employees of the United States, but in all the rights and duties and privileges of citizenship they will be in the same status of freedom as other citizens.

"Provision will be made for transferring citizen tenants from one location to another or from one industry to another when they may desire such transfer, but desertion from the service at any time will stop all the benefits of such service, including the retiring pension after fifty years of age. Signed: Theodore Goodwill, General commanding."

Preparatory to peopling the city on the plan outlined in this proclamation, provisions were made for conducting a dairy and livestock business on a scale sufficient to supply the needs of a city of 175,000 to 200,000 inhabitants. The preparations making for the next crop, including twenty square miles of potatoes, on the high level irrigated district, have already been recounted. The remainder of that high level was early in the season put under water and power and sown to forage crops, such as drilled corn, alfalfa and millet, while the wheat fields sown last fall were all stocked with grass and clover early in the spring. A dairy sufficient to supply the prospective needs of the city was indispensible. Accordingly the government agents were instructed to buy choice young milch cows in the best dairying regions of the United States for shipment to Fort Goodwill, as called for, until their number reached 20,000. For their accommodation suitable barns and other arrangements were built on the tract lying below the city level, in continuation of the industrial district, but north of the continuation of Western avenue. This dairy establishment extended from near the border of the storage reservoir nearly two miles eastward along the avenue toward the city. The initial structure of this dairy establishment was a railway track, which was brought up along the bank of the reservoir until it crossed the line of the western avenue, and then curving eastward and mounting a steel trestle to the height of a little more than ten

feet it was continued as an elevated railway parallel with the western avenue.

On either side of this elevated track at the distance of 30 feet from its center the cow barns were placed so that they stood in pairs, with their ends toward the track exactly opposite each other, and 60 feet apart. Two hundred of such barns were constructed at this time, one hundred on each side



Section of Cow Barn Frame.

of the track, forming a street with the elevated railway down its center. Each of these buildings was constructed on steel frames modeled as in the diagram and placed four feet apart in the building. The size of each of these buildings is, width 33 feet, length, 216 feet, height of lower story, 10 feet, height of second story to plates, 12 feet. Each such building will accommodate in comfort 100 cows.

Between each of these buildings and the next similar building on the same side of the track, an open space of 42 feet was left, making each barn and its corresponding yard occupy 75 feet along the track.

Through the center of each of these barns, on the second floor, a railway track is laid, which extends on a trestle from the end of the barn toward the elevated track in the street. The height of the barns is carefully adjusted to that of the elevated track so that these tracks in each pair of barns connect with a turntable in that elevated track, and by this arrangement a carload of fodder can be taken from the field and run directly into the fodder loft of any one of these buildings without unloading, an arrangement that will be appreciated when it is remembered that on the Fort Goodwill farms all farm wagons are railway cars.

The walls and roofs of these buildings are closed with a special kind of the wood pulp board previously mentioned. For this use it is made about one-third of an inch thick and saturated as it is made with plaster of paris, forming a hard, white board, very pleasant to the eye. For roofing, it is further treated with a kind of paint, making it impervious to water. The side walls of the lower stories are closed entirely with doors, each of which is made in two equal sections, upper and lower, in such a manner that the lower section can slide up over the upper, and thus doubled, the whole may be swung on horizontal hinges up against the ceiling of the cow floor. To make these doors, the plaster of paris board is strengthened by iron borders, and in these borders all catches and fastenings are fixed. The walls of the fodder lofts above are also made in two sections, of which the lower one is fixed, while the upper section slides down over it or is raised and fastened in place, opening or closing the wall as desired. The upper stories at the ends are fitted with large sliding doors over the car tracks, and below there are doors suitable for the passage of keepers and apparatus, but excepting these doors, the end walls are closed with plaster board fixed in place. The ground floor of these

cow barns is made of paving brick laid in cement. It is arranged with a cow walk five feet wide on each side, then a bedding floor elevated six inches above the cow walk from which it is separated by a bevel faced curb stone. Toward the center from this bedding floor is the stanchion rail fifteen inches high and the manger two feet wide; within this, in the center of the building, is the feeding alley, five feet wide, separated from the mangers on either side by a rail and partition three feet high. At the ends of the building and at intervals of forty feet, that is between each group of ten cows on each side, and the next group, are cross walks for the convenience of the keepers. The upper floors of these buildings are of tile laid on iron, but the center strip over the feeding alley, between the rails of the car track, is left open excepting for the cross ties once in four feet, formed by the girders of the frames of the building, and for movable bridges at intervals for the convenience of keepers.

There is a vertical ladder from the feeding alley to the fodder loft at each cross walk. These barns, above and below are illuminated at night with incandescent electric lights, and the fodder lofts above are fitted with machinery both for moving the cars and for quickly unloading them by electric power, depositing the load wherever it may be desired.

To attend each building with its hundred cows is the duty of only one man at a time. At 5 a. m. the first relief goes on duty, feeds the cows and makes their morning toilet, at 7 he bathes and dries their udders, and adjusts the pneumatic milking machine to fifty of them at a time, and milks them by means of a pneumatic exhaust pump worked by electric power, which he manipulates in such a manner as to produce the alternate relaxation and tension needed.* This milks the cows to the

*Since this matter has been in manuscript, newspaper descriptions have been published of a similar milking machine in actual use, but operated by hand power and applied to two cows only, at a time.

perfect satisfaction both of the human beneficiaries and the cows themselves. The first fifty cows being milked, the keeper shifts the milking attachments with their tubes to the other side of the feeding alley and repeats the operation. When the milking is complete, he cleanses the pneumatic calf, as he calls the milking apparatus, by blowing through the tubes first cold water, then hot water and steam, from pipes provided for that purpose in a room under the trestle at the end of the barn. Then the cows are again fed. At 9 a. m. they are turned loose in the exercising ranges for exercise and water. They might be watered in the barns, which in the winter in severe weather is done, but to guard the cows against the danger of injuring their health by laziness the watering troughs are placed at a distance of not less than half a mile back from the cow barns. The cows having left the barn, the attendant cleans the cow walk and the bedding floor, throwing all manure outside to dry. At 12 m. a new supply of food is placed in the mangers, and the cows are free to come back, which they do of their own accord.

At 1 p. m. the second relief comes on duty. He again turns the cows out for exercise and water at 2 p. m. Then he puts all dried manure, outside the barn, on the automatic cars provided for that purpose and sends it to the fertilizer factory, again cleans the cow walk and the bedding floor, readmits the cows at 4 p. m. and feeds them a little at a time as they consume what he gives them. At 7 p. m. he again milks the cows and afterwards cleanses the milking apparatus as before. Then again attending to the comfort of his charge, and supplying them with food according to their appetites, he leaves them at 9 p. m. Through the eight hours from 9 p. m. to 5 a. m. one watchman with a beat like a policeman through ten buildings is sufficient for every contingency likely to arise.

CHAPTER X.

At right angles to the street of dairy barns at its end nearest the city another line of stock barns and yards was afterwards built on plans similar to those already described, but modified to suit the special uses for which they were designed. The elevated railway track curved at the end of the line of dairy barns and continued along this street of barns also. These barns served to accommodate other bovine stock than milch cows during the winter when such cattle could not be put to pasture, and here were kept 2,000 saddle horses also, for school exercises, and for the use of couriers in the mountain wilds.

Behind the cow barns toward the north the land is laid out in parallel strips 300 feet wide extending back from two to three and one-half miles to where the mountain slopes became too steep for their purpose; or rather, since 20 feet was fenced off from the border of each such strip to contain a water pipe and a double row of forest trees, they were but 280 feet wide. These are the exercising ranges for the cows. Into each such strip four pairs of cow barns open, so that when they are turned loose 800 cows occupy each such strip. At the distance of half a mile back from the barns the drinking cups for the cows begin; they are placed in the fences bordering the strips at intervals of ten feet and continue for a mile along each side of the strips.

These cups project, like the cups of bird cages, from the side of the fence away from the cows, the opening into them being just sufficient to allow one cow to drink at a time. The water is admitted into each of these cups by a valve controlled by a float, so that the cup is kept full and no water runs over.

The water pipes which run along the 20 foot strips between these ranges are connected with a reservoir on the heights behind them, and they supply not only the drinking cups and the barns, but also serve to water the shade trees, which in a double row along each strip, of many kinds artistically mingled, were planted next year.

These have since grown to fine proportions, furnishing abundant shade and giving great beauty to the district, besides serving an excellent purpose as a windbreak. Another contrivance, of which there are many in each cow range, is curious; these are the flytraps, which are arrangements of revolving brushes so set that they sweep a cow all over as she passes through, brushing the flies as they arise from the cow into a screenwire receiver, where they are effectually trapped. Each such flytrap is arranged with a treadmill floor which skates the cow through when she enters it, and prevents her loitering there to monopolize its benefits; the motion of this floor revolves the brushes, which are arranged to brush the cow's legs and feet and every part of her body. It doesn't take a cow long to learn the use of this apparatus and to enjoy it greatly, and it is amusing to see a procession of them, as one may on any warm day, tobogganing through one of these fly traps and engaging in a frisky frolic with each other as they emerge. So effective is this arrangement, that the flies around these ranges are never very numerous, though the accumulation inside the screens is considerable. These trapped flies, dead and alive, are fumigated with sulphur at intervals and deposited in the fertilizing material. The ranges, too, are kept carefully cleaned, and this alone would keep the flies within bounds.

During the winter, when water in the open air would be frozen into ice, the supply to these ranges is shut off, and water warmed to a proper temperature is supplied to the cows in their

stalls through a system of pipes provided for that purpose, but even then, excepting during severe storms, the cows are still turned out to exercise at the regular hours.

Another important division of the Fort Goodwill livestock is the poultry department. There are about 600 acres devoted to this use (it is not found profitable to crowd anything) but there are about 1,000,000 hens at all times kept on hand here, besides turkeys, ducks, and other fowls needed to make the assortment complete. It is needless to describe the arrangements; they are, of course, the most perfect of their kind. Every improvement anywhere discovered is at once tested, and if found to be a real improvement, adopted. All fowls are hatched in incubators, the largest and best in the world being kept constantly in operation here, for these poultry yards are so conducted that their output shall abundantly supply every want for poultry and eggs for every inhabitant of Fort Goodwill, of the mining villages, the camps of the forces temporarily employed in this region, and for a time even the forces employed in the Southern California field. And the supply needed is not small, for, as Henry George remarked, men, as well as hen hawks, eat chickens, and a population exceeding half a million eat a good many.

Closely connected with these matters are the fertilizer works. These constituted a departure from all previous large scale farming so novel that a description of them must not be omitted here.

Private enterprise, for many years before the opening of this narrative, had in several instances undertaken the cultivation of wheat and other special farming on a very large scale, but, the object in all these cases having been the enrichment of the proprietor as quickly as possible while the remote future was disregarded, these bonanza farms, as they were called in

the 19th century, were always located on fertile soil to begin with, and, from the first, entered upon a course of progressive exhaustion of the earth. Under this governmental management, however, the enrichment of any person was no part of the program.

Crops were grown for food, not for the market; current prices cut no figure in the matter, and the remote future was cared for as conscientiously as the next crop. This farming enterprise was designed to last as long as man should inhabit the earth, and the managers made it a point of conscience and of pride that the fertility of these lands, rich as they were in the outset, should increase rather than diminish from the very beginning; hence this rule was rigidly observed, that for every crop taken off, an equivalent return of fertilizing matter must be made to the land from which it was taken.

The physical and chemical examination yearly of every part of the soil under cultivation was a part of the system adopted, and in this way all deficiencies were ascertained and corrected.

A considerable part of the supply of fertilizing material is derived from the sewerage of the city. This is carried through a continuation of the main subway sewer girdling the city along its park front, down the western slope from the terrace until it strikes the line of Western avenue, thence along the line of that avenue westward past the parks and gardens, past the poultry ranges and the livestock and dairy districts, nearly to the storage reservoir. There it curves toward the south past the abattoir and the tanneries, receiving the drainage of all these on its way. It terminates near the main canal in two large basins, each having a surface of about five acres. Only one of these basins receives the outflow at any one time; when the basin in use becomes full, a large quantity of lime is turned

in, in the form of whitewash made as thick as it will flow. This, agitated by machinery with the fluid contents of the basin until thoroughly mixed, causes the solid substances to separate and they are allowed to settle. Then the clear water is drawn off into the irrigating canal and the basin is allowed to refill with sewerage. This process is repeated until the deposit formed in the basin is sufficient to cover its bottom to the depth of six to eight feet when dry. The sewerage is then turned into the other basin where it receives the same treatment, while the deposit in the first dries and is excavated, the excavation and removal of the mass being done by machinery, of course.

As with the farmer of old, so here, the manure from the stables and the cow ranges formed the most bulky part of the fertilizing material. Here, however, manure is not spread on the fields with a fork after the manner of the old-time farmer, and the different mode of application necessitates a different treatment. Here, as has been mentioned, the manure from the cowbarns is thrown out daily and dried in the sunshine, a process favored through the greater part of the year by the aridity of the climate. This dried material is then put on cars which remove it to the grinding mills. These are in form much like great meat cutting machines. In the hoppers of these, this dried manure is mingled in due proportion with the deposit from the sewerage and the combination is reduced to a coarse powder. From these mills the ground manure is delivered on carrier belts which convey it to another line of automatic cars running on elevated tracks through the tops of a series of sheds fitted to receive and store the fertilizing material into which they drop their loads. This is the main bulk of the fertilizer used; there is, however, another and stronger mixture produced in large quantities, which is stored by itself to be used according to the requirements of special localities or special

crops. In the poultry department of Fort Goodwill, in which the ranges are great enough to afford much freedom of exercise for the fowls but not to supply any considerable portion of their food as a natural product of the soil, in order to keep the health of the fowls and the production of eggs at their highest point much animal food is required and also a free supply of the limey constituents of bone. To meet this need, the heads and all parts not desired for food of the animals slaughtered at the general abattoir are cut up by machinery and dried and crushed before any decomposition can take place. The product resulting is given freely to the fowls, and after it is sorted over and mostly eaten by them, the remaining parts are swept up with the droppings and conveyed to a special mill, where, together with all bones collected from the city kitchens and dining rooms, and all vegetable ashes, the mass is dried and ground to form the Fort Goodwill phosphate.

In due time the hundred square miles of wheat fields were harvested, the wheat threshed, put in sacks and delivered on cars at the sides of the fields, all at one operation, by combined machines moved across the field in the same manner that the plows and seed drills were moved at the time of the sowing. A rack attached to the harvester gathered, also, as much of the straw as it was desired to save, the amount being regulated by the height at which the grain was cut, and delivered it at the side of the field where it was received by other machines and compressed, put on cars, and taken to storage barns in the stock district. The yield of this first crop was excellent, amounting altogether to 1,800,000 bushels.

As soon as the wheat was removed the ground was again irrigated to promote the growth of young grass and clover, and very soon all cattle other than cows at the time giving milk, were turned into these fields to pasture.

Other machinery adapted to various uses on these irrigated lands had been prepared. The twenty square miles of potatoes, which early in June had been planted on the upper district, were planted by power planters which cut the seed into pieces of the proper size, dropped them eight inches apart, and covered them in shallow trenches which the machine plowed as it went, forming rows four feet apart. At the proper times they were cultivated by machines moved in the same manner, and when in October the time had come for harvesting the potatoes the way they were rolled out of the ground, picked and sorted by the power potato diggers was a sight to open the eyes of the old-time farmer and make him bid good-bye to his backache forevermore.

Preparatory to digging the potatoes the ripened tops are first gathered and taken to the pulp mill to be treated to produce fiber for plaster board and other forms of material used in building. Then the digging machines, drawn across the field by the power shafts and cables, run scoops under two rows at a time, throwing the potatoes and earth on a screen which sifts out the earth and conveys it back into the trenches from which it has been taken. All stones and clods are sorted out and rejected by a gravity device, and the potatoes are sorted into three grades. Those small enough to pass through an inch and a quarter screen are saved for food for swine, poultry and other stock; those larger than that, but small enough to pass through a two and a quarter inch screen, are reserved for seed, and all larger than that are kept for human use.

All are carried along on a conveyance attached to the machine for that purpose and delivered on the cars at the side of the field.

Of this first crop of potatoes there were of all sorts something more than 1,500,000 bushels. This land from which the

potatoes had been gathered was the first to receive a dressing of the fertilizing material, the manufacture of which has been described. It was taken to the fields in trolley cars, each fitted with a hopper box and with roller feeding mechanism connected with the land wheels. On the border of the field the car is lifted and turned, the broad land wheels are attached, and the car moves across the field and back, drawn by the power cables, distributing its load at a rate fixed by the feed gauge as it goes. When the load is spread the land rollers are removed from the car and again as a trolley car it returns for another load.

Preparatory to the peopling of the city and the final breaking up of the temporary camp on the slope east of the industrial district between the foot of the city terrace and the irrigating canal, an irrigating ditch or small canal was cut along the foot of the terrace above that slope, and when the camp was abandoned this area was irrigated by the old open ditch method and afterwards plowed with portable engines preparatory to planting it with apple trees in the spring.

Extensive orchards for plum and cherry trees, and gardens for small fruits were at the same time laid out on the potato land.

As fast as the houses in the city were completed the accepted applicants for enrollment in the citizen tenantry, with their families, were installed in them. The industries were manned from their ranks under foremen promoted for merit from the former service, and, before the winter set in, the aspect of the city had changed from that of an industrial military camp to that of a thriving town filled with happy people, among whom were women and children in the usual proportions.

To serve the needs of these people, the cooking and food delivery service was moved into the basements of the public buildings which during the preceding winter had served as barracks for the army of occupation. These buildings now received their permanent fittings and were transformed to suit their final uses. The laundry department continued its services to the whole people in its original site, and the lectures, which had been a routine part of the instruction of the army, were continued as an adjunct of the schools and adapted to the needs of the new adult population. Examinations, for honors and promotion, on the subject matter of these lectures were adopted for the purpose of cultivating among these people the habit of careful attention, and the regular hours and the system prevailing in everything greatly promoted the lecture going habit.

CHAPTER XI.

With the close of this season of 1915 Fort Goodwill had assumed normal conditions. The works of that season in this region had again given employment to the greater part of the army, though a division somewhat larger than that of the previous year had remained to push forward the works in southern California. Again, for the winter, the great body of the army was returned to the San Bernardino district, where they gave the work in the quarries of the San Jacinto and on the mysterious foundations in the valley of the Santa Margarita a tremendous push, while many other auxiliary works were advanced in proportion. With the return of spring, the energies of two-thirds of the army were again applied in Utah. This season, the irrigating works were pushed as never before.

Toward the construction of the great dam on the Green River canyon, the rocky bed had been cleared and carved to receive the masonry, and five courses of granite, each three feet thick, had been laid all solid in cement across the floor of the canyon. This structure did not yet reach entirely across the canyon, but it measured more than half a mile from end to end and 433 feet from front to back. Behind this foundation a pond was formed, and over it, all through the winter and the floods of spring, the river poured, finding here the hardest and most indestructible bed in all its course. With the return of spring the quarries of granite on the heights near by, from which the stone for this dam was taken, were enlarged. Ten thousand stone cutters, each working with power chisels and every device that could make their work effective, were fitting the great blocks each to the place for which it was measured in the plan.

From the quarries and stone yards above, a broad belt of tramways led down the slope to this base of the great dam, and on these tramways the blocks of dressed stone, each mounted on a truck and controlled by a cable, were passing down continually, and the empty trucks were as continually ascending. On the surface of the dam below, these trucks with their loads were switched onto movable tracks along which they ran to the places where the stone was needed; with all this, of course, there was everywhere hoisting machinery and every convenience for handling the stone. Over the edge of the pond behind this dam of masonry was stretched a double track of strong wire cables along which in continuous procession came dumping baskets each loaded with a ton or more of earth, which they dropped in the water just behind the stonework. This earth was taken from the excavations made for the irrigating canals, the trolley roads along their banks bringing it to deposit here from long distances up the White River canal on the left bank and from the Green River canal on the right.

This season added 150 feet to the height of the dam, making its height 165 feet. Up the White river in Colorado, at the other end of the canal on the left bank, the great 175 feet dam was pushed in like manner, and completed with the close of the season, and when work on the Green River dam was renewed in the spring of 1917 the waters of the White river were flowing through the canal into the great Green River reservoir. This year, too, the system of irrigation on the wheat fields of 1914-15 was changed from the surface to the subsoil method. In making this change, the power system being already on the ground saved a world of work. Trenches from three to four feet deep, ten feet apart, and only six inches wide at the bottom, were cut across the fields by machines drawn by the power shafts and cables in the same manner as

the plows and reapers were moved; perforated pipes were laid in these trenches and covered with a foot of crushed stone. Cross pipes connected them at intervals to equalize the circulation of the water, and to adapt the system to varying levels each level was shut off by itself and connected with the higher parts by float valves, so that the water could nowhere rise higher than six inches below the surface of the ground. Then the trenches were refilled with earth, and after this the irrigation of the fields only needed that the water should be turned on and shut off at a valve at the proper times and the mellow surface of the ground remained unmelted and untrodden from seed time to harvest.

Two hundred square miles of new land this season were fitted for irrigation and put under power in the White River district, and now there was a farm under cultivation amply large enough to feed the army and the people of the towns, to produce enough of all kinds of food needed which it was possible to produce in this region, with an excess for exchange, and to permit a proper rotation of crops, and everything was done by the most effective methods that, under an ideally perfect system of agriculture, could be devised.

But these works were designed not only to feed the army and the people of Fort Goodwill, but to make all this arid desert of the west bud and blossom like a garden. Anticipating the need, when the great dam on the Green River canyon would be completed, work was now pushed with renewed energy and tripled force on the tunnelled canal and its continuation on the south side of the mountain to the new reservoir on Prices river. And preliminary work was now begun to found and build another city as large as Fort Goodwill, to be the center of the new agricultural district here to be developed. According to the plan adopted by the management of

these campaigns of peace and usefulness, certain conditions were required in a town site, which may be specified thus: 1st, a sufficient supply of good water must be attainable; 2nd, in order to provide for the drainage of sewers into the agricultural land where the organic matter which they carry may be restored to the earth and not be wasted nor become a source of pollution to the waters of the region, the town site must be on a higher level than the neighboring agricultural land; 3rd, in order to distribute the water through the town by its own pressure it was held desirable that there should be other land in the vicinity at a higher level than the town site, though this condition might be dispensed with if necessary by the substitution of power water works; 4th, convenience of access between a town and its tributary territory is necessary, and the beauty of its surroundings should be considered.

When the Fort Goodwill and San Bernardino railway was constructed, two years before, it was found best to cross the canyon of the Green river a little below the mouth of the Uintah, to its east side, and to lay the course of the road down the canyon for about a hundred miles toward the south on that side of the river. The last six or eight miles of this course, after crossing about twenty miles of plain, skirts along the foot of a mesa or plateau lying on the east side of the railway. This is part of a large mesa occupying the angle between the Green and the Grand rivers, which has a length of about thirty miles and an outline much like the continent of South America. The level of this plateau lies above that of the main irrigating canal planned for this region, but the surveys had shown that by constructing an aqueduct across the canyon of the Grand river from a group of high mountains on the east side of that chasm, water enough could be obtained not only to supply the needs of the city to be built there, but also to make a garden of the

entire plateau. This essential condition being met, a beautiful terrace on the northwestern part of the mesa just above the bend of the railway was selected for the site of the new city, and Mount Ceres was the name chosen for it. Here, however, great preparatory works were necessary to bring the water to the ground before this site could be habitable for more than a working force whose needs could be supplied by railway. There was a great aqueduct to be built across the canyon of the Grand river at an enormous height, and girdling canals must be constructed about the mountains, and a reservoir built to collect the water from a region to all appearance as dry as Sahara. These works were now undertaken. To complete them, two or three years would be needed before the city could be built, but there was not here, as there had been at Fort Goodwill, any pressing need for its immediate building.

In laying out the city of Mount Ceres the same general plan was followed as that adopted for Fort Goodwill, but it was pursued without hurry by a moderate force of from 2,000 to 4,000 men, for whose support on the ground provision was made.

In the San Bernardino district, meanwhile, the quarries of the San Jacinto were kept running with the maximum force employed, and the stone, all cut to specifications and marked for its place, was piling up over miles and miles of territory in the Santa Margarita valley and across the plain between the San Jacinto mountains and Redlands where the grading and excavating for foundations was going on. The force engaged in doing this grading and excavating had mostly been withdrawn during summer to assist in the works in Utah, but as the season advanced and the works for which there was pressing need drew near completion the men came back. All through the summer, too, small detachments were busy about

a hundred auxiliary enterprises. A limey shale, which when properly burned, constituted the best of portland cement without further compounding, had been found in inexhaustible quantities, and works were constructed for preparing it on a large scale. Great lime kilns had been operated since the year before, The explorations to ascertain the mineral and geological resources of the country were carried on without intermission; artesian wells were bored for exploratory purposes at regular intervals in all parts of the region until they penetrated the primeval granite, and all the strata of which the land is built were as well known and as minutely mapped as the surface of the country. Salt was found to exist in abundance in many places, but at present that was a matter of no consequence. The sulphur deposits which had long been known to exist near the Mexican boundary were carefully examined with regard to their extent, with the result that preparations were making to utilize them in some manner not yet apparent. Copper ore was also found in the southern extension of the San Bernardino range. Up in the northern part of the Mohave desert, natural gas was found in great abundance, and much activity seemed to be centered about that discovery, every well from which gas flowed being carefully capped and closed in the meanwhile. The great deposits of borax and soda in Death valley were also objects of much attention.

Early in September of this year, train loads of structural steel from Fort Goodwill, mostly of a very massive type, began to arrive daily at San Bernardino. Up to this time the production of water pipe, rails, shafting and electrical machinery had overshadowed all other activities in the Fort Goodwill iron works and machine shops, but a standing order was given, as the call for other products slackened, to produce structural steel up to the capacity of the works and send it to San Bernardino.

For this steel a few definite sizes and patterns were given, and every piece was most carefully inspected, any flaw or imperfection causing it to be rejected.

On the plateau about the border of which the great subway and sewer was begun during the first season of operations in this vicinity, no great activity was apparent. Plats and plans covering the whole tract were on exhibition in the offices of the department of construction and all architects were invited to contribute ideas, plans and drawings, or criticisms tending to perfect the future city in beauty or convenience.

As plans were perfected and accepted the sewer and subway system tributary to the first great girdling subway, which was now nearly completed, was pushed along to serve the needs of the buildings to be erected. Temporary buildings were constructed to provide for present needs. Here and there among these temporary structures some gem of a building intended to be permanent was in course of construction. Trees were planted and tended on every part of the plateau under the care and management of the landscape artists, in accordance with plans that had been subjected to the criticism of all and received suggestions from whoever thought he could point out an imperfection or suggest an improvement, but deliberation was as marked in all proceedings here as haste had been in the building of Fort Goodwill. The growing town had, meanwhile, received the name of New Utopia.

The catacombs of the quarries were growing to immense proportions, and up on the San Jacinto mountains the absence of browsing stock and the retention of the water in the ravines and reservoirs had already produced a marked increase of verdure.

CHAPTER XII.

(1916 continued.)

During this year, work on the grading and the mysterious foundations in the valley of the Santa Margarita was pushed with greater vigor than ever before. Even during the rush of the season, when most of the army were employed in the Utah operations, more than fifty thousand men, exclusive of the quarrymen and those engaged in removing the stone and other materials to their final location, remained to push the work here, and great numbers of these foundation piers had already been built.

The district covered by these works had become well defined. From a point about four miles southwest of the southern limit of the New Utopia plateau it extended in a belt five miles wide to the distance of sixteen miles a little east of north. Then turning toward the northeast and preserving the same width of five miles it extended in a direct line nearly to the top of the highest part of the San Bernardino range of mountains, passing the isolated main peak on its eastern flank.

From the point of beginning toward the sea, the tract covered by these works, instead of continuing in a strip five miles wide, spreads out in a fan or funnel shape, the northern and western boundary, bending about the southern spur of the Santa Ana hills, took a direction a little south of west and continued in a straight line to the Pacific Ocean, the other, or eastern margin, bending a very little toward the west, crosses the channel of the Santa Margarita river and also that of the San Luis Rey, striking the Pacific about two and a half miles

south of the latter. The points of intersection of these marginal lines with the coast are twenty-one miles apart.

Within these boundaries, founded on the bedrock as before described, lines of foundations parallel with the eastern margin of the tract were built a quarter of a mile apart; twenty-one such lines including the margins in that part of the tract that is five miles wide.

In the lines these foundations were built exactly 264 feet apart from center to center and carefully aligned with those in other lines so that straight lines from margin to margin 264 feet apart would pass over the exact center of a foundation pier in each of the 21 lines.

In the marginal lines these piers were made so massive that they formed a continuous bed of masonry 300 feet broad. The foundation piers in the inner lines were 50 feet square at the top, the bases greater; they rested on the bed rock, however far below the surface of the ground that might be, and were finished at such a height always that a straight line drawn from the top of any pier to the tops of the neighboring piers in the same line and also in the lines on either side would pass clear of all obstructions, that is, in case of the inside lines, leave a clear line of sight from the top of any pier to the top of the nearest pier in either one of four directions. This work was going on within the area above described at hundreds of places at the same time, but thus far mostly within the belt only five miles wide. Together with what had previously been accomplished, the foundations completed this year were more than enough to cover twenty square miles in the arrangement described without a gap. The entire area of the tract, however, was a little more than 450 square miles.

While this work was going on, the massive structural steel was accumulating faster and faster up at San Bernardino,

each size and pattern of it in immense piles, of each of which each piece was alike.

In connection with this steel, a use was found for the sulphur beds and the copper mines previously mentioned. At the sulphur beds works were constructed for the production of sulphuric acid, and at the copper mines the ore, which was of a low grade but easily worked, was crushed and leached with a solution of sulphuric acid piped there from the acid works, and a beautiful solution of blue vitriol was obtained in quantities as large as might be desired. Meanwhile, at the steel depositaries at San Bernardino great vats were constructed with roller ways leading into them from the stacks of steel. These vats were fitted with electrical apparatus, the sulphate of copper solution from the leaching vats at the mines was piped into them, and then a new industry was started, namely, the electro plating of all this steel with copper, which was done very heavily and in the most perfect manner possible.

One hundred and forty miles north of San Bernardino and twenty miles east, is the depressed area which from the time the country was first explored has been known as Death valley. It is 160 feet below the level of the sea, and therefore the heat of the desert is more intense there than on higher levels. No rain was ever known to fall there, and there the alkalies of the desert had accumulated for ages.

This deposit had long been a source from which unlimited quantities of borax had been obtained. Forty miles further south, and thence forty miles to the eastward, was the heart of the natural gas district which had been discovered by the artesian well exploration.

The eastern side of Death valley is bordered by a range of mountains reaching the height of 6,000 feet, known as the Black mountains, and the southern part of this range bends to

the eastward terminating in a spur which lies 25 miles southeast of Death valley. Between this spur and another terminating 18 miles further north, on the east side of the range, lies an elevated irregular plain sloping toward the east. On these heights rain falls in its season, and when it falls there is a considerable stream of water poured across this rugged plain into the Salt Lake of Southern California, which, 17 miles long and from one to three miles wide, stretches from north to south across the foot of the broad valley or rugged plain mentioned, and past the foot of the southern spur of the Black mountains. The Fort Goodwill and New Utopia railway runs along the western border of this lake. Here, then, were all the conditions essential to a town site. The stream pouring down from the Black mountains into the Salt lake, though but a dry bed through the greater part of the year, when its waters should be stored in a suitable reservoir would furnish an ample supply for a moderate sized town, and for gardens in the valley. The slope along the margin of the lake, with the railway passing across it, afforded a convenient site for accessibility, and with its outlook across the lake to another range of mountains on the east and over the future gardens in the valley above to the Black mountains in the west, while the landscape opened up over the broad plain of the Mohave desert on the south; the site promised to be as beautiful as one could wish. On this desert plain, a short distance to the southward, was white quartz sand in unlimited quantities; this, with the borax and soda of Death valley, and the natural gas near by, furnished all the elements needed for the manufacture of glass in unlimited quantities.

Here, then, a town was built, consisting of four of the Fort Goodwill blocks for residence purposes, and an enormous glass

factory by the side of the railway below as its only industry, and the name given to this town was Vitre.

Since many years before the time of which we speak, it had become a notable fact that steel, glass, and most of the staple products of industry had become the products of "plants" to a far greater degree than they were the products of labor. Some human labor, of course, was needed to tend the plants and keep them in a productive condition, but it was, as it is yet, the size and perfection of the plant rather than the force employed that determined the output, and this glass plant was immense beyond anything of its kind.

What use could possibly be made of the immense quantities of glass that could be produced here was something that the world could not imagine, especially since the supply of glass of all kinds had for a long time so far exceeded the demand that many glass factories had been closed and many glass merchants reduced to bankruptcy within recent years. So out of keeping with all apparent uses this military glass factory seemed, that the idea became current that the management of the army was insane, an idea to which the mysterious foundations, the great accumulations of steel at San Bernardino and the copper plating works connected therewith had previously given rise, and which was sedulously promulgated by the capitalists of the land. But it was replied that all this, and especially this, had been considered by the board of savants to whom the plans had been submitted before the military industrial program had been entered upon; beyond this, not a word in regard to the purpose of all these works did the authorities divulge. Their magnitude made them a world's wonder and such they remained until their progress made their form and purpose evident.

Meanwhile, however, the facts that these works were cost-

ing the people nothing, that the army had now become wholly self supporting, and that while nearly 200,000 families had now escaped from poverty into ease and plenty in the citizen tenantry, the amelioration of their condition had led to reforms which wrought a corresponding improvement in the condition of the masses everywhere, prevented any formidable opposition which might otherwise have arisen.

The capitalists, however, were inconsolable. Business, they declared, was ruined, their occupation was gone, and these were the hardest times that history has recorded, all in consequence of the detestable socialistic policy that had been pursued in the management of the army.

Among the millions of the people, however, these capitalists were but few, and the changes which had taken want and the fear of want from the millions had not put that few in any danger of want; the same abundance of nature's storehouses which had been opened to the millions was open to them also. It was their power to oppress, only, that had been taken away from them, and the people said, if this be madness, give us more of it.

From this it resulted that in the presidential election which took place in November, 1916, the existing administration was re-elected by a majority that was simply overwhelming in every state of the Union, and "businessmen's government" was finally and hopelessly turned down.

CHAPTER XIII.

The population of Fort Goodwill had now grown to something more than 320,000 of whom more than 300,000 were of the citizen tenantry.

The labor required of all adult citizens according to the conditions of enrollment in the citizen tenantry had promoted a very active and happy, as well as orderly, mode of life among the inhabitants.

The four hours of labor per day required of women sufficed to permit the organization of a corps of housekeepers who, under the charge of forewomen of their own selection, kept all the public buildings of the city neat and attractive while the task afforded scope for a talent in which, fortunately, many women excell and which it is desirable to cultivate in all. From among the women, also, was organized a corps of table waiters who serve in the public dining rooms, in which service mechanical carrying devices reduced the labor to a minimum. Women also attend the spinning and spooling machinery and the looms in the cotton, woolen and silk mills, as they did under the old regime. And, as of yore, women are the teachers in the primary grades of the public schools. Many of them also serve as lecturers in the educational courses and fill professorships in the higher grades of schools, for these positions are open to every one who can demonstrate ability to hold an audience and can pass the examinations and accomplish the purpose of the lectures, without regard to sex or previous occupation.

The systematic employment and public life of the Fort Goodwill people proved a great promoter of intellectual life, as did the habit of close attention and accurate observation which was cultivated in the schools.

The custom of hearing lectures daily, also, put the life of the people generally on a far higher plane than any, unless it were some small, select circles in any other city up to that time, had attained. Men, women and children, alike had something more interesting to hear and to see, to think of, and to talk of, than gossip and chit-chat.

In Fort Goodwill the school system is the foundation of intellectual life for the whole people. Each of the large buildings first erected at the corners of the blocks is, in accordance with the original design, in its second story a schoolhouse. These were sufficient to serve the needs of the people for the primary grades. For the more advanced courses suitable provision was made in the tract reserved for that purpose under the name of Education park.

Education being here regarded as the object and consummation of life, and, not, as in other cities and former times it had been, as merely a preparation for and incident in life, required far more ample accommodations than had been given to that object in any former city of like population. And yet, whenever the weather would permit, which in the delightful climate of Fort Goodwill is the greater part of the year, a large part of the school exercises were held in the open air.

The trees in the Fort Goodwill parks and about the public buildings in the corner squares, though in vigorous health and growing rapidly under the fostering care of the board of forestry, at the time of which we are speaking, were yet too young to furnish the shade needed; but, to prevent the fixing of indoor habits in teachers as well as scholars, awnings were erected under which a part of the exercises of every class were conducted.

The methods of teaching adopted in Fort Goodwill were a radical departure from any system previously in vogue else-

where, except that of the kindergarten, of which the Fort Goodwill system is a development.

There was a change of purpose, which may be summarized in the statement that education rather than instruction was the object sought, and a change of methods which strikingly appears in the fact that nature was the text book, no books being put in the hands of the pupils for study. Libraries were placed at the disposal of teachers and pupils alike, but teaching was the work required of live teachers and not to be relegated to dead print. The result was that within a year the children in the Fort Goodwill schools became the brightest and strongest thinkers in the schools of the country. So marked was this fact that the school boards of many cities sent men for the special purpose of examining and reporting on the Fort Goodwill school system.

One of these inspecting visitors was Professor X. from Boston, Mass., from whose report we quote the description that follows:

The next morning after my arrival in Fort Goodwill I introduced myself to Colonel M. in charge of the department of education. In the course of our conversation I chanced to remark that the excellent schools of the city certainly gave to the Fort Goodwill children a magnificent preparation for life. "Preparation for life, sir!" remarked the Colonel, "you seem to be in error. Education is not a preparation for life, it *is* life; in so far as anyone falls short of education he falls short of life. But come with me and let us take a look at the children and what they are doing."

We approached Education park shortly before the second morning session, and as we drew near the ground our ears were greeted with the sound of rather lively music accompanied by merry shouting and singing. Approaching yet nearer, we per-

ceived that three of the boys had constituted themselves into a military band with bugle and fife and drum, and they were leading a very lively procession in half a march and half a dance to the old tune of Captain Jinks, to which the procession kept step while they sang with variations,

"I'm Captain Jinks of the Horse Marines,
I feed my horse on corn and beans,
Which used to be beyond the means
Of Captain Jinks of the army.
I teach young ladies how to dance,
To sing and dance,
To sing and dance,
I teach young ladies how to dance,
I'm Captain Jinks of the army.
I'm Captain Jinks of the Horse Marines,
And now we raise our corn and beans,
Such things are quite within the means
Of Captain Jinks of the army."

"Well, Colonel," I remarked, "it is pleasant to get rid of that old-time wail of poverty that, like an undertone of distress, ran through almost everything, even the rollicking, strutting, devil may care music of Captain Jinks." The Colonel smiled assent, but just then the bell sounded for school, and, laughing and shouting, the children scattered to the several awnings where the teachers were to meet their classes. "This," said the Colonel, "is a section of the fourth grade observation class." As the teacher called the numbers to the number of twenty, the children took their places in line.

"We will first hear what you discovered in regard to the substance," said the teacher. "Number one: What can you tell us?"

"The substance was in the form of round masses, greyish white, hard, but not so hard but I could cut it with my knife, it shaved fine like horn when cut, softened slowly when the shavings were put in water; don't know what it is." "Very

well; Number two: Can you tell us anything that John has omitted?" "No." "Number three?" "No." "Number four, Mary S.?" "Yes, I found that the powdered substance would burn when put on a hot iron, turning first brown, then black, and smoking it smelled like burned bread. I believe the masses are made of dough." "Very well; go to the head. William, can you tell us anything about the substance that the others omitted?" "No." "Number six?" "No." "Number seven?" "No." "Number eight?" "Yes. They are heavier than water, because when dropped in water they sank. When I scraped one of the masses and dropped the powder in water it slowly sank. When I boiled the water it mixed with it and thickened it like starch. I tried burning it, too, and noticed the same smell like burning bread. I believe they are made of flour." "Very well; go to the head. Number nine: Can you tell us anything else about the substance?" "No." "Number ten?" "No." "Number eleven?" "No." "Number twelve?" "Yes; I did not try burning it, but I crushed it in water and boiled it, and noticing that it acted like starch, I remembered hearing my brother tell that iodine was a test for starch, so I got a drop or two of his iodine solution and put it into some of the thickened water, and it immediately turned blue, proving that the substance was starch. Then I wanted to see whether there was anything else in it, so after I had boiled it well, I strained it through a fine cloth and found there was a gummy substance that did not easily go through, nor, after I had washed it well with hot water, turn blue with iodine, and further I found some flakes that looked like bran. I believe the masses are made of whole wheat flour.

The class cheered this particularly bright report. "Well done," said the teacher, "go to the head. Number thirteen: Can you tell us anything about the substance that we haven't

heard?" "No." "Is there anyone else that can? Let him hold up his hand. No one has anything further to tell us about it. Well, children you have examined the substance very well. It consists of whole wheat flour made wet with water, pressed into moulds, boiled in the moulds and dried. We will now hear what you have found about the plant. Number thirteen: Tell us what you have noticed." The plant on this occasion was white clover, and the very many noticeable points that it presented gave almost every pupil a chance to mention something that the others had omitted. Those who mentioned some point that the others had omitted took their places at number thirteen until the question had come round to number one again.

I asked Colonel M. whether it was not found that some were dull and discouraged in the competition with the particularly bright children, and he replied, "Yes, but we transfer particularly dull children to other sections more suitable for them until we get them interested. As soon as we get their interest among others of about their own ability they make rapid progress. The particularly bright children, too, are transferred to other sections where the race between them is kept lively, and, as you see, we break the monotony by changing the topic in the same exercise, in this instance from a substance to a plant. Let us visit a section of the advanced class in geography," said Colonel M., and following him to another awning, I heard the teacher state this problem: "After a journey of unknown length taken during a period of unconsciousness, I find myself in a country where there are rugged mountains, some of which, during the greater part of the year, are tipped with snow. Some of these mountains come down to the sea, forming high, rugged promontories enclosing deep, landlocked bays. The country appears to be well wooded with

deciduous trees, and, though mountainous as a whole, there are extensive grassy plains and great forests. Much of the land has been converted into farms. Wheat, oats, corn, apples, plums and peaches, grass and clover are growing there, and sheep, cattle and horses abound. I see, too, that there are railways here, and electric lights and power, that the people are well up to the times in their ways of doing their work, and, passing among them, I find that their language is English. When I am on such journeys as this, however, I am invisible and can ask no questions. It being a season of the year when the days and nights are nearly equal, I notice that the sun at noon is, as nearly as can be ascertained without instruments, half way between the zenith and the horizon, but, on watching it, one thing strikes me strangely, instead of moving from left to right, as I have always seen it move, the sun is passing across the sky from right to left. Think of this for five minutes and tell me where I am."

When the five minutes were up the teacher asked all who thought they could locate the region described to raise their hand. Nearly all the class did so. "John: You may tell where the place in which I find myself is located." "New Zealand," said John.

"Are the rest of the class in accord with this answer? Any-one who thinks it is elsewhere, hold up the hand."

No hand was raised. "Then you are all agreed that it is New Zealand. William: Tell us why you conclude that it is New Zealand."

"From the nature of the crops and the forest, also from the height of the sun at noon when the days and nights are equal, the location is in the temperate zone and in the latitude of the forties. But, since the sun is moving from right to left, instead of from left to right, it is in the south temperate zone. The

lands lying in that latitude are South Africa, the southern part of South America, South Australia, New Zealand and a few small islands. By the description it is not a small island. In South Africa the English language is spoken in part, but the character of the country is wholly different from the description given. It might possibly be some part of the coast of Chile, but there the language spoken is Spanish. Australia is not rugged enough on any part of its coast to fit the description, and it is also too arid. There remains only New Zealand, and that fills the bill perfectly."

"Very well; has anyone anything to add, or any criticism to make?" One hand went up. "Well, Charles, what have you to offer?"

"I think Tasmania should have been mentioned; I agree with the conclusion, however."

"The point is well taken," said the teacher. "Frank, you may tell us why in the south temperate zone we should see the sun moving from right to left, instead of from left to right."

"If I lie down on my back with my head toward the south and watch the course of the sun here, it will be from right to left. The direction of the sun's apparent motion in this respect depends on the position of the observer's body with regard to it. But, the earth being a sphere, there is some part of its surface where the body of a man standing erect will be parallel to any possible position.

"To find the point where my body when standing erect will be parallel to its position here when lying flat on my back I must go, in the direction my head points, over a portion of the earth's circumference equal to the angular difference between the direction of my head from my feet when standing erect and when lying down, which in this case is one quarter of the way round the earth, or ninety degrees of latitude toward the south.

Our latitude here is close to forty degrees north. Take ninety degrees from forty degrees of north latitude and its leaves minus fifty degrees of north latitude, that is fifty degrees of south latitude, at which point on this meridian my body when standing erect would be parallel with its position here when lying down on a horizontal plane with my head toward the south. A similar calculation will give a similar result with corresponding differences of latitude from any point where the sun is ordinarily seen moving from left to right, which is any point in the north temperate zone, from which it follows that from any point in the south temperate zone the sun will, to a person standing erect, be seen moving across the sky from right to left in a path corresponding to that in which from the corresponding latitude in the northern hemisphere it is seen moving from left to right."

"Very good. Has anyone any other explanation to offer, or any criticism to make? If so, raise the hand."

About a dozen hands went up.

"Mary C.: What have you to say regarding the matter?"

"We have always been taught," said Mary, "that in the southern hemisphere the sun is seen moving across the northern instead of the southern sky, and, as it rises in the east and sets in the west in the northern and southern hemispheres alike, if in the southern hemisphere it moves across the northern instead of the southern sky it must move from right to left. If it moved across the northern sky here, it would move from right to left. I think that is a simpler explanation than Frank's." The class cheered approval.

"So it is," said the teacher, "and correct, but not so scientific as Frank's in that it fails to set forth the reason why things are as they are. Has anyone anything else to add? None. The answers given are entirely correct, likewise the reasoning.

But I am subject to these strange, unconscious journeyings, and again I find myself in a strange place.

"This time, I am on a small wooded island, apparently uninhabited. Near the shore grow the white birch, white poplar and hemlock; close to the beach are clusters of creeping juniper growing in the wind driven sand, there is the erect variety, also, a little back. The white cedar is growing in every springy or swampy place, and the hemlock, mingled with beech and white oak, is found over nearly the whole island. On a sandy flat yonder is a grove of Norway pine. Blackberry briars and raspberries abound on the higher parts of the island, also gooseberry bushes and black currants here find their congenial haunts under nature's planting. The blackberry briars are in blossom, and the tips of the young hemlock branches droop over the darker fronds in pale and tender green tassels, very beautiful to see. The sun rides high in the sky, passing from left to right, my shadow at noon being not much longer than my stride when walking vigorously. Looking out over the water, there is no other land to be seen, except in one direction where a blue line on the horizon indicates a distant shore. The waves roll long and high, like the ocean, but I can see no sea-weed nor any shells on the shore. There is much driftwood, however, and some of it bears the marks of ax and saw. I taste of the water, and find it fresh and good to drink. Where am I, and what is the time of the year? William and Frank may be excused from answering."

This problem proved even more fruitful than the other. The answer worked out was, an island in Lake Superior, the northern part of Lake Michigan or Lake Huron; time, the last part of June or the first part of July.

"This," said Colonel M., "will fairly illustrate to you our manner of school work. We lead the children to use their own

faculties, to observe closely and reason correctly, to form their own conclusions from their own data. The whole course in our schools is in direct continuation from the kindergarten work. When we teach a child to read we do not tell him the names of the letters, but teach him their use in simple words, having previously taught him to notice particularly their forms with those of many other objects. In teaching mathematics, we dwell especially on the reasoning, regarding it the most important use of a mathematical course to teach a pupil in what proof consists and to distinguish the difference between evidence and assertion, no matter how ancient the assertion may be.

"In history we teach our pupils to trace events and conditions back to their causes. The law of causation and the evolutionary philosophy we keep in sight in all things.

"We teach no language but our own, and, while our pupils take naturally to the use of our libraries in their search for information regarding the thousands of topics that come to their attention, the use of text books is no part of our school work. Teachers may use them, but it is the teacher's business to lead his pupils forward in knowledge and intelligence from nature and not from books."

"By the way, Colonel," I remarked, "I haven't seen a horse in this region, nor heard his name mentioned, except in that absurd Captain Jinks song. Do these children really know what a horse is?"

"Oh, yes," said the Colonel, "horseback exercises are a special line of training in our schools. The rocky height yonder, that occupies the middle of Educational park, is threaded in all directions with bridle paths, while the more level ground at its foot on either side is especially prepared for equestrian evolutions. The equestrian classes, which include both boys

and girls, are exercised in all manner of riding feats, including hasty scrambles over the height and reforming for evolutions on the other side. The horse with us is a means of physical training, and also a sort of avant-courier of civilization. When in city or field, on mountain or plain, we have got our machinery in order, we have no further use for the horse, but until then he comes in handy. Besides, we have always need for couriers in the mountains, for whose use the horse is indispensable. We will, if you please, see the equestrian class exercise tomorrow morning between 8 and 9 a. m."

This we did, and I may say that for action and life no wild west show nor circus could compare with the evolutions and feats of the 1,200 young riders which, the next morning, I witnessed from the top of a rocky pinnacle on the height which Colonel M. pointed out to me.

The riding classes, I learned, were in four grades, exercising one hour each, from 8 to 9 and from 10 to 11 a. m., and from 1 to 2 and from 3 to 4 p. m., the beginners taking the last hour and passing to the next earlier as they advance in proficiency, the same horses serving for all with an hour's rest after each hour of exercise, and beginning fresh in the morning for the most advanced grade of riders.

CHAPTER XIV.

Fort Goodwill, even at this early epoch, was the cleanest city on earth. Its streets were paved as fast as the residences bordering them were completed. The body of the pavement used was a thick bed of macadam, or crushed stone, rolled into compactness with heavy rollers and covered, on some streets, with asphaltum, from the great deposits of that material which for many years before the period of this history were known to exist in eastern Utah; on other streets the pavement was covered with cement; in either case a hard, smooth, dustless surface was produced, which under the rubber tires of the automobiles and bicycles remained for years as perfect as when first laid. Along the borders of these streets and about the houses were well kept lawns and rapidly growing young shade trees in pleasing variety, while in the squares along the diagonals of the blocks the lawns and walks were beautified with shrubbery which had already attained such a development that in its varieties there were bloom and foliage to brighten every season.

These border lawns and trees were kept under the care of the department of forestry, and the same men that cared for them swept the streets and removed all fallen leaves or other litter, a light task, since horses were never admitted into the city excepting on one street only. This one street along which horses passed daily was named Equestrian avenue. It extends from the stables to the equestrian campus in Education park parallel to Western avenue, but a mile to the north of that dividing line, and this avenue was swept twice daily and thoroughly washed once a week.

In the former epoch of horse traffic it was not realized how great a deliverance awaited the world when the horse in every day life should be dispensed with. The labor required to support and care for a horse was always greater than that required to support a man, and in addition to this labor there was the plague of flies and dust and dirt and odor forever hanging round the haunts of the horse. In dispensing with horse traffic and traction, at least one-third of the sum total of labor necessary to maintain civilized life was dispensed with. And yet, though this is the horseless epoch so long predicted, the time is not in sight when the horse will be as rare as the elephant or the giraffe.

There is very little traffic on the streets of Fort Goodwill, the mail carriers in making their morning and afternoon deliveries use light automobiles, and they deliver any moderate-sized parcels which may be sent from the stores, with the mail. Gas being the only fuel used in the city, not only is the atmosphere clear of smoke, but there is no coal to convey nor ashes to remove. Since all food is received and prepared, and nearly all of it eaten, at the public kitchens and dining rooms in the corner buildings, the city is as clear of garbage as it is of ashes and smoke. All scraps and waste portions of food are collected at these great dining halls and conveyed to the poultry and live stock department by a systematized service.

In these kitchens the food is cooked with economy and skill in every style that fancy may call for; it is carried to the tables by automatic waiters similar to some of the cash carrying arrangements in use in large stores during the former epoch.

In the dining rooms, which are adorned with works of art and palms and flowers, soft music plays while the people are served.

If, owing to the presence of young children or for any other cause, any family prefers seclusion, an alcove is set apart for them and sequestered with Japanese screens. When, however, any prefer to take their meals at their own homes, they have but to announce that fact and give their order by telephone, which, of course, no house is without, and at the time appointed the desired food is delivered to them from automobile cars prepared for that purpose with hot and cold chambers, and later another automobile calls and removes the dishes and remnants of the meal.

In addition to the public dining rooms in the buildings on the corners of the blocks, there is another system of restaurants connected with the workshops in the industrial district, in which each workman serving his eight-hour shift takes one meal, and consequently in all industries that operate continuously through the twenty-four hours three meals per day are served in these restaurants as in the general dining rooms.

Visiting one of these workshop restaurants connected with the department of machinery, in which 4,000 men eat at the same time, we see a great building 800 feet long with arched roof of glass. On the side opposite the workshops this building is flanked by the kitchens, and on that nearest them by the lavatories through which the men enter to take their seats at the tables. In the daytime, when the light shining on the arched glass ceiling would be too intense, it is toned down to pleasantness by daintily colored screens and curtains, at night the hall is brilliantly lighted by electricity. Along the center of this hall is a long row of palm trees, and in the window bays at the sides roses and tropical plants embower it in beauty and verdure. Along either side of the center aisle, with its row of palms, is a double row of tables, and over the aisles between the rows of tables, is the system of mechanical waiters communicat-

ing with the kitchens, which carries all food and returns dishes, reducing the labor of the waiters to a minimum.

Ten minutes before a meal is served a signal sounds in the workshops by an electric button, touched by the superintendent of cuisine in the kitchen, which signals the machinery to stop and calls all hands to the lavatories. Here the men wash and remove their overalls. From the lavatories they march into the dining hall, where on a balcony over the entrances, embowered in tropical foliage and brilliant with flowers, a band of music is playing a lively air with strongly marked time to which the men instinctively keep step as they march to the tables. Here they seat themselves in groups of ten at a table. Four hundred such tables, arranged in four lines of one hundred tables in a line, fill the hall, providing seats for four thousand workmen. Here they are served with a meal as substantial as hunger could desire and as daintily cooked as the most fastidious appetite could wish.

Forty minutes are allowed for the meal, while soft music by the band on the balcony permeates the hall, but does not interrupt conversation in the least. Then another signal sounds, the band again strikes up a march and the men return to the lavatories, where they resume their working garb, and at the end of ten minutes they are again at their places among the buzzing machinery.

Everybody in Fort Goodwill uses the bicycle. Bicycle paths, the easiest and cheapest of all roads to make, have been constructed far into the country in all directions; into the wildest glens, up the sloping sides of the mountains, along the banks of the canals, by the margins of the canyons, there is nothing of wildness or grandeur or magnificence that is beyond the reach of the bicycle. Bicycle excursions and picnic parties go out frequently to lunch at interesting places ten, twenty,

or even thirty miles distant, and the independent wheelman, alone or by twos and threes, finds any point within ten or twelve miles easily accessible after his daily eight hours of service have been rendered. Certainly the invention of the bicycle trebled the sum of human freedom. On bicycles, in all reasonable weather, the children go to school, and the older people many of them to their meals or to their work, to entertainments or to lectures, though for these purposes automobile cars wait on them in sufficient numbers to carry all whose inclinations lead them to prefer that mode of transit rather than the activity which the bicycle implies.

Fort Goodwill is mostly a city of small houses, but with the mode of life prevailing here, with no food to cook in the houses and no kitchens, with all laundry work done in the public service, with no ashes and no smoke, the labor of housekeeping is almost nothing. Each house has hot water as well as cold, this being supplied by a single gas burner running in proper adjustment to a water tank, which is found amply sufficient to supply a hot water service always ready for any purpose in every private house. Fireplaces, arranged with numerous jets of gas mingled with air in such proportions as to give the almost invisible blue flame, heat every house in any weather as warm as may be desired. These thin blue flames shooting among plates and fringes of fire clay and asbestos, heat them white hot and so give a brilliant fire as well as a clean one, and one that is perfectly under control, as it can be turned high or turned low at pleasure by the touch of a button, while a flue above each such fire furnishes the most perfect and satisfactory mode of ventilation that has yet been discovered.

These open hearth fires! Since the days when the pioneer rolled the huge backlog into the great mud-walled fireplace, and sent the flame and smoke of his cordwood fire rolling up

his great chimney of mud and sticks, to this last refinement of fire without smoke or ashes, people have never ceased to take pleasure in them, and poets have never ceased to sing their praises. While hot air furnaces, and steam radiators, and air-tight stoves have poured forth their heat without light, often the memories of the aged have turned back with love and longing to the open hearth fire and mourned its loss as they would mourn a friend departed; now it has returned with all its old-time comfort and cheer, but minus all its old-time smoke, ashes and dirt.

This gas fuel is most economical, too. The gasworks are down in the industrial district, where there is use for all the coke produced in manufacturing this gas, and where all the spare heat generated about the gas retorts is utilized also.

By adopting this mode of heating the great city with all its great industries is made, to the eye, as smokeless as a meadow, and the dews of summer fall as sweet in the gardens, and the flowers bloom as fresh and bright as in the fairest islands of the sea.

But we have been considering the small individual houses only. These form the greater part of the city, but not the whole. For families with children single houses are a necessity, but for childless people, of whom there are always many, and of which class the parents of many children often come to be when the children are grown, an isolated house is both lonesome and wasteful. There was need in Fort Goodwill to provide homes for pensioners from the army retired at the age limit, or disabled by accident or disease, who were without relatives to people a house with them. For these, blocks of apartments with the conveniences of the best equipped hotels, were the most desirable residences, and for their use many such buildings were constructed, affording by their size opportunities for

the display of many features of architectural beauty which the smaller houses did not permit, and relieving the city from the sameness to which the great multiplication of small houses might have tended.

To people visiting Fort Goodwill from the commercial cities of the competitive world, its greatest peculiarity was the absence of the business district. The great blocks of stores and offices, which constituted the heart of every old-time city, were without any counterpart or likeness here, and their absence made the city seem to the old-time business man like a fine residence district with the city left out altogether, and so it was as the nineteenth century understood a city, but the people who lived here were happy and free. The many occasions that brought the people together here in large numbers extended the circle of every one's acquaintance very greatly beyond the possibilities of former conditions, and, notwithstanding the eight hours of service per day required of every man, and the four hours required of every woman, there was never before a city whose people had so much of leisure as the people of Fort Goodwill had, and among them all there was not one who was poor, not one in want nor in danger nor fear of want.

There were among the population of Fort Goodwill several millionaires, who for the sake of the peace and security and the social and intellectual life which it offered, had accepted the conditions required of the citizen tenantry and become residents of the city. They had turned their property into gold, and United States and municipal bonds, and other securities such as would require no attention from them, and they imagined that their holdings would give them some kind of social eminence or distinction here. But in this they were disappointed, without poverty they discovered that riches were without power, the wealth, to accumulate which they had regarded as the chief object of life, had become as worthless as the dead

the chief object of life, had become as worthless as the dead leaves of autumn. None were in need of anything which they could supply, none would serve them for hire, and they were no richer than their neighbors. They had become citizens of Fort Goodwill, but they found that Fort Goodwill was like the Kingdom of Heaven in that it was easier for a camel to pass through the eye of a needle than for a rich man to enter into that citizenship. The man could enter, but when he had done so, though nothing had been taken from him, he was no longer rich, his gold and his bonds were but the pieces in a game not played here, a game which, by the contrast existing between conditions here and former conditions where it was played, he could not fail to perceive was most cruel and murderously destructive to mankind.

Very soon the millionaires of Fort Goodwill discovered that their wealth here had lost its power, it did not take them long to perceive that its former power was but the power to oppress, and they grew ashamed of the part they had played with it.

But though the wealth which these millionaires held was powerless here, it yet held power in the world at large, and, having thoroughly learned the lesson which Fort Goodwill best could teach to them and their class, they conferred with each other, and uniting their means for that purpose they announced to the managers of the industries in which they served, their intention to return to the competitive world and use the wealth which they held to hasten the overthrow of the competitive system, by establishing co-operative communities near the centers of population whose industries and their remuneration should be conducted on the Fort Goodwill plan. This they did, and though other and greater factors were working to the same end, which would have been accomplished even without their aid, the institutions which they planted proved a notable factor in wiping commercialism and the profit system off the earth.

CHAPTER XV.

The Board of Forestry is a branch of the service to which allusion has several times been incidentally made, but whose operations have not hitherto been particularly noticed.

This year, 1917, the nurseries in the Green River canyon contained millions on millions of thrifty young trees now in the third year of their growth, which though not yet so strong and hardy for transplanting as they would be one or two years later, were nevertheless fit for planting in favorable locations, and which with suitable care in such locations would grow to maturity even more quickly than if allowed to develop further in the nurseries.

Accordingly, this year the force under the charge of the Board of Forestry was quadrupled and a large area was planted to forest trees, while a vastly greater area was prepared for such planting in the following spring.

Like creatures of a higher order, trees, in order that they may live and thrive, require a range of temperature within suitable limits, water at such times that they can adapt their active functions to its presence, food, of which the earth nearly everywhere stands ready to furnish abundance, and alternating periods of activity and sleep.

This last mentioned requirement of trees, though it applies to nearly if not quite all plant life, is very often overlooked. In the forest regions of the temperate zones, which, especially in their polar halves, are the greatest wood producing regions of the earth, the rains of spring and summer coincidentally with the increasing warmth of the season, furnish abundant water to supply the needs of the awakening activities of the trees, and continue the supply through a season of warmth sufficiently

long to mature the growth of the season preparatory to their annual sleep through the following winter. In the semi-arid regions of northern Mexico, where the winters are not cold enough to arrest the activities of tree life, where the months of April, May and June are usually without rain, and, June especially, burning under a nearly vertical sun, the deciduous trees, which here assume a low and scrubby habit of growth, turn brown and shed their leaves in May. Through that month and June and July, with their branches as bare of foliage as the forests of the north are in the heart of winter, the trees take their yearly sleep. The rains come on in July, continuing into September, and saturate the earth. Then the trees awaken and again put on their robes of green, the last part of July and August is their spring, our autumn is their summer, and, favored by the coolness of the season and occasional showers, though these are not essential, the oaks on the mountains, the sycamores in the ravines, and the mesquites on the plains retain their foliage in its lively green and mature their growth through the winter. April is their autumn, and with the increasing dryness of May they again go into their annual sleep. The condition necessary to their life is that water and the temperature suited to their growth should come to them at the same time, which here they do during our northern fall and winter, the trees adapt themselves to this condition, whether during their period of sleep the cold of winter or the heat of summer prevails matters not, they can accommodate their habits to either.

Here in Utah, however, while water enough falls during the year to support forest life, it falls mostly during the winter, while the cold makes it impossible for buds and leaves to push forth, the drought of spring and summer prevents their development then, and the result is that, except in specially favored localities, this is a treeless country. For like causes the same

is true of the plateaus of New Mexico and Arizona. The treeless condition of the greater part of Southern California is due more to the greater aridity of the region and less to the rigors of winter.

Here in Utah all that was necessary in order to permit the earth to be clothed with forests was that the water, which in the winter falls on these mountains and plateaus in the form of rain and snow, and which melting in the spring immediately ran away into the canyons, should be retained and applied to the earth in the spring and early summer. Then the trees to be planted would put forth their season's growth, maturing it as the permissible dryness of the autumn increased, and be ready for a vigorous new growth the following season.

Accordingly the ten thousand men, who during the preceding season had been employed in constructing reservoirs at the heads of valleys in the mountains and uplands above the level of the irrigating canals, were this season reinforced by thirty thousand others employed in the same work. In preparing the ground on which to utilize the waters retained in these reservoirs, of course no power system was needed, the old open ditch and trench method of irrigation was followed, and trenches once dug along the face of a slope, retaining water to percolate down to the next trench below, could be left as a permanent improvement, unfilled except as nature might fill them. This mode of irrigation was aided by pipes to cross ravines and surmount heights wherever their use was desirable. On ground prepared in this manner trees were planted, as nearly as convenient, at distances of ten feet apart each way. Regularity not being necessary, some variation was permitted in order to take advantage of the most favorable places in rocky ground. This placed the young trees near enough together to protect each other in some degree from the storms of winter

while they were young and small, while at the same time they were far enough apart to permit them to grow to a useful size before it would be necessary to thin them or they would begin to crowd each other out.

The area planted during the first season in each valley was limited to what could be watered abundantly, and with sufficient frequency to insure the vigorous growth of the young trees through the season. When the leaves had fallen they were retained on the ground in greater and greater proportion each year as the growth of the trees increased. From the first they filled the irrigating trenches and covered the ground in the hollows and sheltered places even on wind swept slopes, where like a sponge they served to retain much of the water falling on the spot during each succeeding winter and spring until it could percolate into the earth. The roots of the young trees at the same time spread wide and deep, and after the first year it was found that fewer irrigations were needed to maintain the trees in healthy vigor.

Thus it was found practicable year after year to enlarge the area of timber watered from each such retaining reservoir, until all the upland valleys and mountain slopes were covered with forests.

The greater part of the ground planted to timber during this season of 1917, however, was in the triangles formed at the ends of the half-mile wide fields where, owing to the diagonal course of the canal or canyon or other obstacle limiting the length of the field, one border reached beyond the other, and an area remained where, owing to the lack of one of the opposing power shafts, the machinery for plowing and sowing and gathering the harvests could not be applied. This difficulty could have been obviated by using short auxiliary lines of power shafts, but for the sake of the beauty which the forests

would give to the landscape, and also for the protection of the fields which they would afford from the winds of winter it was preferred to devote these triangles and canyon borders to timber. Here, of course, the irrigating mains supplying the fields were available to furnish all the water needed, and on this favorable ground more attention was given to the landscape gardener's art, in the selection of trees, than in the upland districts remote from the centers of population, where the adaptation of the trees chosen to the location in which they were planted was the only consideration that needed to be regarded. The force employed in planting the trees on these triangles was thirty thousand men, not included in the force previously specified. The total force employed under the direction of the Board of Forestry was increased from year to year until the entire treeless region was clothed with forests. This was deemed of special importance because it was confidently believed that with the spread of the forests the rainfall throughout the arid region would be greatly increased. It has increased to the satisfaction of every reasonable desire, and in causing that increase the work of the department of forestry has been a large factor, but by no means the only one.

CHAPTER XVI.

It was during this season of 1917 that work was begun also for flooding the depressed area in Southern California lying to the eastward of the southern portion of the San Jacinto mountains, and extending up the valley between that group and the San Bernardino range.

This depression forms a geological continuation of the Gulf of California. It owes its origin as a dry valley to the Colorado river, which during geologically recent times has carried down in its current the immense volume of material that formerly filled the grand canyon as well as all tributary canyons and valleys of erosion that, draining into the Colorado, were carved out as the country through which it flows was slowly uplifted. This material borne down the channel of the river and poured into the gulf in the form of mud, sand and gravel, completely filled it opposite the river's mouth, and for some distance in each direction, excepting that the river maintained for itself a channel to the gulf along the eastern border of its delta.

The sand and gravel which the river continued to carry into the gulf were thrown up by the waves and piled up in dunes by the wind on the made lands previously formed, until in many places these dunes reached a height of two or three hundred feet, but, like dunes everywhere, alternating with depressions reaching down to the water level, or even enclosing hollows filled with water below that level, which would afterward be mostly filled with sand blown by the wind.

As this tract of made land grew opposite the mouth of the Colorado river, the waters of the upper part of the gulf were

shut off from the sea. Thus enclosed, under a tropical sun, in a rainless region, it was inevitable that the waters enclosed should in a very few years dry out, as they did, leaving a desert, hot, dry and inhospitable to the last degree, in a depressed valley which in its deepest part reaches a depth of 300 feet below the level of the sea.

To refill this depression it was necessary to excavate a channel, the greater part of which lay through Mexican territory. Accordingly, the consent of the Mexican Government was sought permitting the forces under the command of General Goodwill to excavate such a channel and providing for its maintenance afterwards by the joint action of the governments of Mexico and the United States. This consent was very cordially given. As a matter of courtesy in acknowledgment of this concession, the privilege was offered to the Mexican Government to name the body of water to be formed. This privilege the Mexicans accepted and named it in honor of their greatest president, Lake Diaz.

These preliminaries having been arranged and the line surveyed along which the canal was to be excavated, in the spring of 1917 a dozen powerful dredges were sent round into the Gulf of California to proceed to the site fixed for the mouth of the proposed channel and begin the excavation. There was no such hurry to complete this enterprise as to make land excavations necessary along the line of the channel, and the twelve dredges were ranged side by side, each cutting fifty feet wide and twenty-five feet deep below the water level, while the mud-scows and tugs attending them carried the material which the dredges removed away into the deep waters of the gulf. Thus they cut a channel 600 feet wide and twenty-five feet deep as they advanced. Four other dredges soon followed them to

remove the earth which slid down the banks and keep in order the channel which the others had made.

These dredges worked night and day, making progress fast or slow, according to whether the land through which they were cutting lay low or consisted of dunes piled high. A land camp was established alongside of the work as the dredges advanced, which was connected by rail with San Bernardino and New Utopia. This brought to the work prompt supplies of whatever was needed for its unremitting prosecution, and on the sixth day of May, 1918, thirteen months and ten days after the dredging was begun, water began to flow back inland from the gulf. The volume of this stream rapidly increased, spreading widely over the sand as it flowed; but two or three days more of dredging caused the current to flow with such volume that it scoured for itself a deep channel and it became necessary for the dredges to drop anchors to prevent their being carried away with it. This channel became so deep and broad that within five days more the depression was filled and the flow of water ceased.

The point in the Colorado river where this dredged channel begins is near its entrance to the gulf, and when the river is low the water there is brackish, a mixture of river and sea water; at the time when Lake Diaz was filled, however, the spring flood was pouring down the Colorado and the fresh water of the river displaced the sea water to a considerable distance out into the gulf. So great, however, was the current setting back into the depressed area that the river, though at its flood, was reversed, and a large volume of sea water was drawn in with it, so much so that the contents of the new lake from the beginning were sufficiently salt to be suited to the propagation of oysters and salt water fish. Since this channel was completed the current of the river, diminished though it is by the

diversion of its waters for irrigating purposes, is yet sufficient to dilute the current setting into the new lake and prevent its becoming a huge solar salt pan.

Of course the sand creeping into the new channel along its sides, and the bar continually building across its mouth, have made it necessary to keep dredges continually at work in order to keep the channel open to the desired depth, especially so since the purpose was to make the channel a broad one that would ultimately maintain itself.

During the twenty-nine years that have elapsed since the water was admitted to Lake Diaz, that channel has spread into a strait half a mile wide. The sand yet creeps down its gently shelving bottom from the shores, but slowly now, and it is not necessary to employ more than three dredges to keep it open to its full depth, where during the first four or five years a dozen were needed to prevent its filling up entirely.

Lake Diaz now, though covering less than one-third of the area from which in ancient times the gulf was barred out, has nevertheless an area of more than 1,200 square miles. This, through a geologic epoch has been as inhospitable a desert as existed on the face of the earth. Until thirty years ago the barren sands glowed and blistered there under the torrid sun, there sand and dust storms were engendered so thick that daylight could scarcely penetrate them, and so penetrating and all pervasive that travelers passing by on the swift trains of the Southern Pacific railway, in sleeping cars, closed as tightly as possible against the dust, were yet at such times almost stifled, their eyes, mouths and noses filled with dust, their seats and beds like ash heaps, while they gasped in the dust laden air at the temperature of 120 Fahrenheit. Where this was the picture thirty years ago, now sparkling waves are dancing in the sunlight, imparting coolness and life to the breezes that blow over

their surface. The white sails of a hundred pleasure yachts flit over the green water, dainty fish are caught there sufficient to supply the wants of a million people, and its oyster beds yield the choicest oysters in the world.

Formerly the desert here repelled all atmospheric moisture from its surface like a red hot stove, now the cool surface of the lake, combined with other favoring conditions created since Lake Diaz was filled, causes the precipitation of occasional showers, and of heavy dews about its borders nearly every summer night, while during the heat of summer every day it pours into the atmosphere by evaporation water enough to fill a lake a mile square to the depth of a hundred feet, all of which is added to the amount that falls in other localities formerly arid over which the summer breezes spread it.

CHAPTER XVII.

During the fall of 1917 and the following winter the perfected industrial plants of Fort Goodwill, manned now not by the army, but by the citizen tenantry, were putting forth their normal product. The great steel works were sending to the plating vats at San Bernardino from ten to twenty trains per day loaded with structural steel which, copper plated as fast as received, was piling up in the sunshine mountain wide if not mountain high. Great reels of annealed nickel steel wire, copper plated like the rest, were likewise accumulating in quantities hitherto undreamed of. The lines of stone foundations, which at our last account were sufficient, if massed together in the order of the plan, to have covered twenty square miles of the four hundred and fifty included in the tract marked out for them, had by the end of this year been carried to such an extent that they covered one hundred and twenty square miles of that area, and throughout the straight reach, extending from the upper bend north of New Utopia, to the foot of the San Bernardino range, they were completed and the working force removed to other parts of the tract.

At the intersection of the northwestern border of the tract with the coast line, near the point San Mateo, a great pier of solid masonry was building on a point of rocks that projected into the sea, and over which the waves dashed until they were fenced out by the works. This pier was designed to be a circular platform five hundred feet broad, of hewn stone fitted into the bed rock, its sides slanting at an angle of thirty degrees, and its top finished at the height of ten feet above high water mark. From the center of this platform a straight line

was surveyed tangent to the most projecting points of the shore line and for nearly fifteen miles, excepting at these few points of tangency, lying wholly in the shallow water of the ocean's margin.

Along this line at this time preparations were making for building other foundation piers at intervals of a quarter of a mile, such piers being in the continuation of each line of foundations embodied in the general plan. From the point where this ocean front line intersected the shore line and passed inland it was continued as one of the cross lines of foundations to the southeastern margin of the tract, which by design it met at right angles. From the pier that marked the point of departure of this ocean front line from the sea, another line was drawn, like the first tangent to the shore, but over the water, to its intersection with the continuation of the southeast margin of the tract, where another great pier was built similar to the first, or San Mateo marginal pier. The interior lines of foundations were laid out at right angles to the first, or San Mateo sea tangent line, which made them also parallel to the southeastern margin of the tract built upon.

Within the borders of the tract thus defined the work was, during this winter of 1917-18, so far advanced that the whole world was now convinced that the great work, whatever it was to be, was to cover the entire tract, but as to its character and ultimate purpose the authorities were as silent as the sphinx.

Meanwhile out on the northern margin of the Mohave desert, the product of the great glassworks at Vitre was piling up along the railway for miles on miles in the form of stacks of unpolished plate glass slabs, each piece like every other, rectangular, 25 inches by 10, half an inch thick, rolled with bevelled margins. These plates were piled as high as the strength of the material would permit without danger of frac-

ture, each layer separated from the others by leaves of yuca or Spanish bayonet, and of these stacks there were already hundreds of thousands of cords.

It was as long ago as 1898 that liquid air was first demonstrated to the world as a substance obtainable automatically in large quantities and possessing qualities indicating that it might become a source of power, taking the place which water filled in the steam engine, but with the important difference that in the liquid air engine the heat of the universe would serve as furnace and fuel; that on the coldest day in the coldest place on earth with liquid air in the boiler there would be heat enough and to spare to produce any amount of power. For, while water boils at 212 Fahrenheit, and the heat available for power in the steam engine must begin to count from that point as its zero, liquid air boils at minus 312 Fahrenheit, and in the liquid air engine all heat above that point must count on the scale as available for power.

It was Charles E. Tripler, of New York, who, in 1898, after a long series of experiments and researches, first published and demonstrated so much as this. He thought he had the whole problem solved; that he could build and operate an engine that would without fuel propel a ship at sea until her machinery wore out, or run any kind or size of power plant without fuel indefinitely. He did run with it the engine that he used in his own laboratory, but, when the attempt was made to utilize the discovery, practical difficulties that were hard and slow to overcome stood in the way. The discovery was genuine, but when it was attempted to operate an engine with liquid air in the ordinary work for which engines are required, when the working parts of the engine must operate in a temperature such that soft rolled iron would break in it like the most frangible of

glass, in which the watery particles in the atmosphere would congeal and smother the engine with ice, while the temperature of the engine was continually changing through a range of more than 400 degrees, all sorts of breakages occurred, and stoppages and annoyances were frequent of many kinds new and strange. Hence, capitalists and users of engines, who were disposed to let well enough alone, condemned the new power and opposed its introduction.

Mr. Tripler yet lived, but his means were no longer adequate to the prosecution of the researches needed to obviate the difficulties in the way of the effective application of his great discovery to the world's work.

However, with the incoming of the reform administration, under which the utilization of the army had been undertaken, certain officers of the government, recognizing the great benefits to mankind which Mr. Tripler's discovery promised, found a place for him and his work in an annex to the Smithsonian Institute. There, for several years, without public mention, without the world's attention having been in any way turned to the matter, the researches and experiments needed were carried on.

In the course of these researches a new department of chemistry and physics had been developed. Of what could the working parts of an engine best be made that must work in a temperature in which iron and steel was so brittle that a light blow would shatter it into a thousand fragments? If the temperature of the whole engine could be kept within two hundred degrees of the boiling point from which its power originated, mercury would have been a promising metal to use in its construction, but with the temperature of the earth ever encroaching on such an engine to melt it into a fluid, of course that metal was out of the question. Many new alloys and bronzes

were discovered, and their qualities under extreme degrees of cold ascertained. Various preparations of wood, horn, Indian rubber and gutta percha were investigated, and every department of the natural world ransacked to find or make a substance that should be strong enough and fine enough in texture to make an engine that would give the power needed and remain unchanged through the great range of temperature to which it must be subjected.

Having such an engine, with what could it be lubricated? The fact that in its working parts all watery particles in the air and all minute fragments of ice that might become detached in the machinery would become like crystals of quartz, a source of destructive friction, must be considered. All oils became solids the moment they were applied to this engine. With alcohol, naptha and most substances known to ordinary chemistry as liquids, it was the same, as also with the gases formerly recognized as liquefiable. In this field it was that new discoveries in chemistry were made, and out of this new chemistry the suggestion of other orders of material being has grown. The conditions of life have been generalized in the scientific mind as lying within a range of temperature in which, while various substances are solids to form a foothold and framework for living things, one substance must exist in the liquid form, in our order water, to serve the vital functions which water serves, and another or other substances must exist in the gaseous form to constitute an atmosphere. As in the existing order an hydrate of oxygen in the liquid form is a fluid universally necessary to life, and dilute oxygen as a gas is the universally necessary atmosphere, so it has become thinkable that an order of nature might exist in which silicate of oxygen, or quartz, might take the place that hydrate of oxygen or water takes in our order of the world, and perhaps mixed gases of

oxygen and hydrogen, now combined as water, might take the place which oxygen and nitrogen takes with us. On the other hand an order of material life is thinkable under conditions of temperature in which hydrate of oxygen shall be a solid rock, such as silicate of oxygen or quartz is with us, while our atmosphere should be the water of that order, and some yet more subtle and volatile gases should form its atmosphere. It is along the line of variation of temperature only that one such order passes into the other.

The Tripler liquid air engine overlaps two such orders, working in the colder order to use the normal temperature of the warmer as power. The steam engine overlapped two such orders, working in the temperature of the existing world, while it reached into the warmer for power. The advantage of the Tripler liquid air engine, in that the normal heat of the world is for it furnace and fuel, is immense.

After four years of research and experiment a satisfactory liquid air engine was produced, but, while workable in engine houses easily constructed anywhere, or in the open air for that matter, it was found to give the best results if worked in a chamber in which the temperature and atmospheric moisture can be controlled.

And now just where power was most needed such chambers were at hand to any extent that might be desired, in the great catacombs of the San Jacinto mountains.

Not all of the immense quantities of stone used in building the great system of foundation piers extending up the valley of the Santa Margarita, from the ocean to the heights of the San Bernardino range, had been taken from these catacombs. Quarries had been opened in the Santa Ana hills, where suitable stone was found much nearer to a large part of the field of operations, and also in the foot of the San Bernardino range,

nevertheless by far the greater part of the stone used came from the San Jacinto quarries, and the catacombs from which it was taken had grown to be immense. Even at the time of which we are now speaking a great city might have been built in them if a race of troglodites had existed there to prefer such a site. Indeed, the long lines of electric lights at the crossings of the galleries, from the working faces of which stone was still being taken as fast as ever, made these catacombs look like the streets of a well lighted city on a dark night, with the difference only that instead of buildings along the sides there was but a monotonous succession of windowless square towers of solid stone, and overhead, instead of a dark sky, there was the same monotonous vaulted roof of rock.

In one of these worked out galleries a length of 840 feet was now walled off from the rest, together with the square side chambers formed by the crossings of six transverse galleries, the whole forming a power house, consisting of a central hall, 840 feet long by 60 feet wide, with six alcoves on each side, each 60 feet square, and the whole 60 feet high. In these chambers the temperature of the air was naturally constant, and its moisture could easily be controlled. They were fitted up with liquid air apparatus, engines and dynamos, capable of producing 500,000 horse power at the points of delivery, scattered about the field of operations, at the average distance of twenty miles from the generating chamber. And, of course, this plant was capable of enlargement to any extent that might be desired. Into these power chambers ran a two-foot water main to carry cold water, for the purpose of cooling the air, which had been heated by condensation under pressure, preparatory to its still further cooling in the liquifying apparatus, and a yet larger pipe, covered with non-conducting material, carried the hot water out, thus conveying away the greater part of the heat

abstracted to make the difference between the air at the temperature of the chambers, 65 Fahrenheit, and at minus 312 Fahrenheit, its highest temperature in the liquid state, in a manner similar to that in which the vapor had always been chilled in the ammonia ice manufacturing apparatus, which worked on the same principle, but preceded the liquid air apparatus by several years.

This liquid air power applied to dynamos, and thus converted into its portable form, electric power, supplied the greatest need of this Southern California district. In the Fort Goodwill region the streams pouring down from mountain heights, and the precipitous courses of the rivers above the level of irrigation, when properly fitted with water wheels and dynamos, were sufficient to furnish all the power needed, but here in Southern California nature had provided of water but a scanty measure. Coal, too, in any sufficient quantities was far to bring; nor was coal as a source of power ever a thing to take delight in, from the mine to the ash heap it was always a blot and a blemish on the earth, an enemy of beauty and a poison to the atmosphere. No blessing so great was ever given to mankind as when the liquid air engine dismissed coal as a source of power forever. Coal we yet need, and use to produce the gas with which we warm and brighten our homes when the weather calls for fire, and as a chemical we still use it in our smelting furnaces to take up the oxygen of the ore, but since the electric smelting furnace has been perfected we no longer use it there as a fuel, even in reducing the most refractory ores of iron into the toughest wire or the finest steel. It needs a practical knowledge of the former epoch to enable one to realize from what an inferno of heat and cinders and stifling gases the world has been delivered by this change.

CHAPTER XVIII.

And now on the long lines of stone foundations that had so long been an enigma to the world, a forest of filigree towers began to rise, filigree to the eye, but of enormous strength, with every piece in the structure of each calculated to bear many times the strain ever likely to come upon it. Along the border foundations, 300 feet wide and solid to the rock ribs of the earth, these towers blend at their bases, uniting their strength in support of each other, but at a height of about 400 feet they separate. In the long straight reach on which the foundations were first completed, and to which part of the field during this season of 1918 the erection of superstructures was limited, they rise to the height of 1,300 feet above their foundations, or to be more exact, where the height of the foundations varies, they rise to the height which will bring their tops, in each line transverse to the tract, to a level at that elevation.

The towers on the intermediate lines of foundations are columns rather than towers, forty feet square at their bases, their feet resting on massive iron slabs centered five feet within the borders of the foundation and at points five feet apart each way over the base within the square drawn through these outer borders, so that each such tower rests on eighty-one such massive legs, all braced together. At the height of 300 feet, and at every succeeding 300 feet in its upward course, each of these towers is braced at the corners to its neighbors in each of four directions by tight drawn cables of steel wire, each strand of which is copper plated. These bracing cables reach from the three hundred feet level down to the foot of the neighboring towers, and also across the space on the same level, while from each higher level, where the bracing cables attach, they reach

their neighboring towers at the level three hundred feet below and also at the same level; thus the strength of all contributes to the support of each, and vertical pressure only needed to be guarded against. In building these towers every rivet, when properly tightened, was carefully brazed with copper, and each tower when completed, covered with its copper plating, shone like gold in the sunshine without a wound or a flaw to mar its perfection.

Each of these towers when it reached its ultimate height was capped with a saddle of steel like those which support the cables in great suspension bridges, and ultimately above all an ornamental cap of aluminum was to cover the structure.

While this forest of towers was rising, as the quantity of structural steel required grew within measurable reach, the work on annealed nickel steel wire in the Fort Goodwill iron works was pushed forward the faster, and the quantity arriving at the San Bernardino plating works grew rapidly greater.

As soon as a section of these towers half a mile wide across the belt was completed, machines devised for that work were set to spinning out of this wire great cables across the tops of the towers from side to side, anchorages having been constructed for each such cable outside the line of border towers at a distance from their base equal to the height of the tower. These cable spinning machines ran on a light steel wire cable that was first carried up and stretched across the top of each line of towers to receive them while the power that operated these machines, and the elevators and hoisting apparatus, and transported all the material, was electricity generated by the liquid air engines in the catacombs of the San Jacintos.

These cables when completed hung parallel to each other exactly 264 feet from center to center, and a sag of 250 feet was

allowed in each quarter of a mile stretch between the towers on which each cable rested.

As soon as each of these suspension cables was completed another cable considerably smaller was suspended horizontally beneath it.

The height of these horizontal cables here, where the width of the whole structure was five miles, was 1,056 feet, which is one-fifth of a mile, making the area of the vertical cross section of five miles width beneath it equal to one square mile.

In so great a work as building this structure all stages of the process were going on at the same time. As soon as the foundations were finished over a considerable section of the field of operations the erection of towers began, but at that time on a very great area of the ground to be covered the foundations were not yet begun. The work of building these towers lasted ten years, that is until the summer of 1928, but the entire structure was finished that year within six months after the last rivet was driven and brazed in building the last tower.

When the towers were built over that part of the tract which spread out to a greater width than five miles, they were not made so high.

On the line of piers which formed the sea front overhanging the waters of the Pacific, the towers were carried to the height of 502 feet only.

When the suspension cables were laid across them, it was done in seven sections, each three miles long, the cables being anchored in the piers within the structure. Here as elsewhere 250 feet being allowed for sag between the towers, the height of the horizontal cable was 252 feet above the foundations. Two hundred and fifty-two feet is a few inches more than the twenty-first part of a mile, hence, the opening beneath this

horizontal cable being twenty-one miles wide, the area of the vertical cross-section beneath it, as before, equaled a little more than one square mile.

At the point where the distance from margin to margin is ten miles, the height of the towers is 780 feet, which equals the tenth part of a mile, 528 feet, plus the 250 feet for sag, with two feet to spare, hence here as elsewhere the area of the vertical cross section beneath the horizontal cable is a trifle more than one square mile.

This, then, was the law of the structure, that it should be so built that the area of its cross section below the horizontal or floor cables should be not less than one square mile.

As the first suspension cables drew near completion, a large force of men began to make of the steel, which had been prepared for that purpose, an immense number of girders, each composed of a straight top rail 264 feet long, flattened and curved at the ends to form saddles to fit over the horizontal cables, and a curved bottom rail bending downward in a bow to the distance of thirty feet from the straight, or floor rail, this also being curved at the ends to form the saddle, fitting into the similar curve on the straight rail, to which it was firmly riveted, and these two throughout their length were trussed together by a lattice of steel strips riveted to the midrib or fin which was rolled for that purpose on the top and bottom rails of the girder.

Every part of these girders, of course, was copper plated like the steel in the towers and the wire in the cables.

These girders, as soon as the cables were ready to receive them, were hoisted to the horizontal cables and laid across the intervals between them at the distance of forty feet apart, and stayed one to the other with fine wire cable. To lie on these girders, steel sash were prepared, each of which contained a

gravity valve of one-third of its area, capable of yielding to pressure from beneath and then dropping back into the general surface, these valves themselves being of sash similar to the rest. Each of these sash, twelve feet by forty in size, was braced beneath in such a manner as to give it ample strength. These sash were made with leaded beds fitted to receive the glass plates which were piled up in such immense quantities in the desert, and which were still pouring forth from the glass works at Vitre in undiminished volumes.

Suspended on horizontal cables stretched along the sides of the border towers were similar sash, but in these the gravity valves constituted two-thirds of the area and were capable of swinging either way. These were a precaution against the pressure of hurricanes, which, against an unyielding surface of so immense an area, might produce a pressure too great to be sustained.

No sooner were these sash in place than workmen were employed in putting in the glass. This work was pushed forward in such a manner that the mountain end was completed first. The structure passing to the eastward of the isolated summit of San Bernardino peak was carried up the side of the great range to the height of 10,000 feet measured at the middle height of the structure. Over this point, the square mile of cross section being still preserved, the roof, floor, or ceiling, whichever it may be preferred to call it, terminated in a strong railing, while the side walls were carried on, tapering as they advanced up the mountain until they terminated in points about 800 feet below the summit of the range.

Long before the structure had reached this stage of completeness its character and purpose had become obvious. It was recognized as a flue, and had come to be known everywhere as the great rain flue of San Bernardino.

CHAPTER XIX.

It was in the fall of 1918 that the great dam on the upper Green river was finished and the collected waters of that stream were turned into the main canal to flow on through the tunneled canal, past the Green River highlands, and thence thirty miles westward parallel to the canyon of the Prices river, to a great reservoir which had been prepared in the upper valley of that spring freshet stream to receive them. In this reservoir the water is retained at the altitude of 5,250 feet above the sea, and following the contour line of this altitude with only just fall enough to give a gentle flow to the water contained, the canal was continued southward, winding about the base of the mountain swells, crossing the ravine of the San Rafael river on a lofty aqueduct, on along the same contour line of altitude, including several large storage reservoirs in its course, until it led again to the neighborhood of the Green River canyon, this time approaching this great ravine at a point southwestward from the city of Mount Ceres and not far above the junction of the Green and Grand River canyons where the great canyon of the Colorado begins. In making this circuit the canal encircles a tract of irrigable land much larger than the entire Fort Goodwill district, but this, to the Green River canyon constitutes the western division, only, of the Mount Ceres agricultural district. The canal, and reservoirs connected with it, bounding this tract, were constructed before the water was admitted to the Prices River reservoir.

The surface of this tract presents a greater variation of level than that of the Fort Goodwill district, ranging, in fact, through more than 1,200 feet, and to provide for its irrigation

many secondary aqueducts were required, similar to that constructed in the first division of the Fort Goodwill district, also many secondary reservoirs at different levels, but there was no hurry now, as was necessary when that first tract was irrigated, and the subsoil system of irrigation was here applied to every field before it was plowed and sown. The water mains and power shafts here were arranged in the same manner as in the Fort Goodwill district, but here, while water power batteries were built on all streams suited to receive them, the main source of power was the liquid air engines acting on dynamos through which their energy was transmuted into electricity.

Up the Grand river in Colorado another great dam and canal were in process of construction, which was completed in the following year.

This was located about twenty miles east of Grand Junction in Colorado, where it forms a reservoir from which the waters of the Grand river are diverted at the altitude of 5,500 feet. Into this reservoir the waters of the Gunnison river also were afterwards conducted from a dam located on that river a short distance above Escalante. This not only utilizes the surplus waters of the Gunnison in the Utah field, but also provides for the irrigation of a large tract of land lying in the angle between that river and the Grand river in Colorado.

The canal from the Grand River reservoir is conducted along the mountain side on the right bank of the Grand river, with just fall enough to give the current sufficient motion to carry the stream at all stages of flood. Where this canal reaches the Utah line it has diverged from the canyon to a distance of a little more than twelve miles. From that point it takes a westward course across the peninsula included between the canyons of the Grand and the Green rivers, following the base of the Brown Cliff mountains, along the north side of

the broad plain which stretches entirely across the interval between those canyons to the northward of the Mount Ceres plateau. This canal provides for the irrigation of all this plain which constitutes the eastern division of the Mount Ceres irrigation district; it also is provided with several large storage reservoirs along its course, the last of which lies near the Green River canyon. Into this reservoir a branch canal has been conducted from the first basin on the outflow from the tunneled canal, both these reservoirs being on the same level. This connection crosses the Green River canyon on a fine aqueduct of steel, uniting the eastern and the western divisions of the irrigating district in such a manner that a surplus of water on either side can be drawn across to the other, or a special demand on either side can draw on both divisions for its supply.

The altitude of this entire district averages more than 500 feet lower than that of the Fort Goodwill district, a large part of it lies at a level more than a thousand feet lower, constituting the lowest land in Utah. It also lies from 120 to 150 miles further south.

In its effect on the climate of a region a foot of altitude is about equal to a mile of latitude, descent being equivalent to southing; hence, between the Fort Goodwill district and this the difference in climate is marked.

The Fort Goodwill district from its altitude is best fitted for the products of the high north, wheat, barley, oats, the grasses, and among fruits, apples, plums, cherries and currants, while in this lower district corn finds its most congenial conditions, and peaches, grapes, and the fruits of more southern regions, thrive better and reach a higher degree of perfection than in the Fort Goodwill district. Accordingly the orchards which are planted in this district are mostly of this class of fruits.

See Map, Chapter 31.

At this time the preliminary work, which during the preceding twenty-eight months had been in progress preparatory to building and peopling the city of Mount Ceres, was far advanced. The mountain group, whose three great peaks tower so grandly to the height of from 12,000 to 13,000 feet just across the Grand River canyon to the southeastward of the city, had been girdled with a canal intercepting all the water precipitated on those heights and the great mountain swell from which they rise.

To reinforce this watershed area the waters were collected in a similar manner from the northern face of the Abajo—lower—mountains, thirty miles further south, and from the highlands intervening between the two groups. This doubled the area of watershed from which the precipitation was collected though the altitude of the supplementary area not being so great it was not expected to double the water supply.

The whole tract, so far as the eye could see, was barren and arid to the last degree, but when the waters precipitated on this area during the year were collected in the lake prepared to receive them, in which they were retained at a level a little more than 6,000 feet above the sea, their volume was found to be very considerable. This lake has an area of from sixty to sixty-five square miles, according to the season, and its stage of flood. It lies in a valley on the saddle of land between the nearer group and the Abajo mountains. From this reservoir the water is conducted to the Mount Ceres mesa in two seven foot pipes, on an aqueduct crossing the Grand River canyon at the height of nearly 2,000 feet above the bed of the river. These pipes conduct the water to another reservoir on the highest part of the Mount Ceres plateau, to which its admission is regulated by float valves, and the supply is amply sufficient

not only for the wants of the city but also to irrigate the mesa abundantly.

This plateau or mesa having an area of about 350 square miles outside of the city of Mount Ceres was, as soon as the water supply was available, put under the charge of a detachment of landscape artists connected with the board of forestry, under whose direction the greater part of its area was planted with forest trees.

On the city site on the northwestern shoulder of the plateau, where the top of the mesa lies about 120 feet below its general level, the ground had been surveyed and the city laid out to the extent of twelve square miles, while the same terrace afforded ample room for extending the city to three times that area. In laying out the city of Mount Ceres, the same general plan was followed as that which had proved so satisfactory in Fort Goodwill, and during this autumn of 1918 the industries needed for the welfare and comfort of the city, and for its building, were established and equipped on the plain at the foot of the mesa in convenient relation to the railroad. The inclined plane elevators between this industrial district and the city site above were made ample for every purpose.

During the following season, 1919, the city was built and provided with every accommodation, both public and private, to meet the needs of 100,000 people, and it was then peopled in the same manner as Fort Goodwill had been peopled before it.

Mount Ceres, as its name implies, was designed to be more distinctly an agricultural city than Fort Goodwill, and to extend and perfect the irrigation and agriculture of their district, and the lines of access to and from its remoter parts, was from the beginning made the chief industry of its people, all public services, schools and lectures being cared for in the meantime as at Fort Goodwill and elsewhere.

CHAPTER XX.

The eight years following were occupied in the completion of the works already inaugurated, while the people increased in numbers and their institutions were growing in perfection.

By the time the great flue was completed, in the autumn of 1928, the citizen tenantry had grown to number more than three millions.

The enlisted men in the army proper were, of course, retiring in constantly increasing numbers on the expiration of their age limit, 50 years. And the privilege of membership in the citizen tenantry being always open to such of the enlisted men as cared to avail themselves of it, also caused the retirement of a great number. Neither was death abolished, though the death rate in the army at no time exceeded that in civil life. To partially compensate for these losses recruits were accepted in such young men as desired to enlist, of whom there were always some, and at the time of the completion of the great flue the army yet numbered more than 200,000 men.

With the perfect system of production and distribution developed under military control and the wonderfully effective machinery used, the eight hour day had been adopted for the purpose of enabling one-fourth of the population between the ages of 21 and 50 to supply all the consumable wealth of every kind that the needs of the whole could call for, while the other three-fourths were occupied in the creation of world improvements not immediately productive of wealth nor contributing to the needs of life. This it was found easy to do, and that with lavish abundance. Surplus manufactures and products were exchanged for every article of utility or luxury which foreign

climes or other conditions produced; the wealth of sea and land was poured into these commissary stores for the needs of all, until all desire was satisfied.

The army was rich; the citizen tenantry was equally so, and a growing surplus was left every year unconsumed which the management donated to meet the wants of the world at large wherever want existed which that surplus could relieve. To consume this surplus a larger portion of the people might have been employed in covering with forests the arid lands not devoted to agriculture, but even this work would in time be completed and it was not thought wise to hasten it faster than it was now progressing. Mankind, it was held, did not live in order that work might be done, but work was to be done, rather, in order that the conditions might be such as best to promote human happiness, that human beings might live and accomplish the highest purpose of their existence, namely, their education and growth in right character.

Accordingly, when it was found that from the work of one-fourth of the population unused wealth was continually accumulating, though the people had in their credits power to withdraw the whole of it, the eight hour day was reduced to six hours, and to meet any deficit in the commissary department that might result from this reduction, the wealth producing force was now recruited from those employed in constructive works. This might well be done since more and more of these works were drawing toward completion. The working time of those employed in constructive works, the army proper as well as the citizen tenantry, was, of course, reduced at the same time and to the same extent as that of the productive industries. The first reduction of the hours of required labor occurred in 1924, four years before the completion of the great flue.

The minds of these people had at this time been illuminated and their tastes cultivated by the constant and systematic attendance on the daily lectures, and by the remarkably efficient schools within whose circle of influence they lived, and now with this increase of leisure there was a remarkable increase of attention to the fine arts, painting, sculpture, architecture, landscape art, music, and the drama, literature and philosophy, all these sprang up and flourished among the people in a manner new to the world's experience.

Whoever had any bent in any of these directions now found opportunity to indulge that bent, and the flood of talent that sprang out of it was a surprise to the world.

The example of these millions, while drawing tribute from none, becoming not only self supporting but rich, and not only rich but cultured, banishing poverty altogether from among them and at the same time becoming a people of leisure, distinguished for their intelligence, the breadth of their knowledge, and the acuteness of their perceptions and understanding, and also for the elegance of their surroundings and the refinement of their lives, this example was not lost on the world at large. Very early, as was noticed, the operations of the army put an end to capitalism in the field of coal mining. The contact of the government railroads, built in connection with the various operations in which the army was employed and rendering their services at cost, with the privately owned system taxing the public what the traffic would bear, also increased the demand everywhere for public ownership of railroads to such an extent that it could not long be resisted.

In response to this demand the capitalists sought to unload their railroads on the nation at the value at which they held them, based on the sum they had been able to extort from the people for their services.

But to this proposition the people said, "no; we will build our railroads, or if we buy any we will pay no more for them than it would cost us to build them," and a few trunk lines built by the public and operated at cost, parallel to the main lines of traffic, very quickly let the water out of the values at which the railways had been held to such an extent that the capitalists were willing to drop their holdings for much less than it would have cost to build the system anew.

Similarly, the object lesson which the citizen tenantry afforded of towns prosperous and happy, from which want and the fear of want had, by systematic co-operation, been banished altogether, although three-fourths of the consumable wealth, produced by only one-fourth of the working force, was avowedly taken to support the other three-fourths of the force who contributed nothing to its production, so increased the restless impatience of the people at large with the poverty and dependence which they had inherited, that legislatures, courts and municipal councils began to yield to the pressure and authorize public workshops and public stores.

The referendum and iniative on local measures, with local self government, became the law everywhere, and towns and cities were no longer forbidden to do for their people anything which any man or association of men might lawfully do. And these rights were extended to country townships also. With the doors thus thrown open to public self help, and the brilliant example of the military cities of Utah to point the way, growth in public co-operation was rapid. Here and there a city or a town opened public store houses and started public industries to stock them, distributing the goods on credits for labor. This relieved the laboring poor in these towns of all anxiety in regard to continuance of employment, and of all fear of want; they were now able to work for themselves and enjoy the full

equivalent of the product of their own labor, and other towns, in order to retain their population, were compelled to follow suit. Of course, as fast as such public co-operation was established the profit system both in merchandise and manufactures vanished. No one would pay a profit for what he could get at cost.

And the banking system and the landlord system vanished with the profit system, the landlord being taxed out of existence by the plan proposed by Henry George, and profit, rent and interest were dead.

Thus, while the co-operative order was perfected under government control on the arid lands of the west, the nation at large followed the same road only a little way behind; otherwise the people would have so pressed and crowded into the citizen tenantry that the new domain would have been overrun and the old seats of wealth and power left a desert.

CHAPTER XXI.

At last in all that concerned its functions the great rain flue stood completed, but the resulting phenomena were a surprise to its builders and to the world. It had been calculated, and correctly, that with the sea breeze for its initial impulse, aided by the expansion of the air as it ascended inside the flue, a continuous current of air must flow through it from the ocean's surface to the mountain's top; that the air gathered from a belt of ocean's surface twenty-one miles wide in this latitude would at all times carry a considerable river of water which must be precipitated at the top of the San Bernardino range, or before reaching that altitude, and this also had been calculated correctly. Nevertheless the result was not precisely what had been expected.

Instead of perpetual rains at the mountain top, a blast of arctic coldness densely loaded with powdery snow was the result, and to the surprise of all the savants who had considered the plan and pronounced it sound, a glacier was gathering with unprecedented rapidity on the heights of the San Bernardino range.

It had been calculated, and correctly, that as the altitude increased and the atmospheric pressure diminished the volume of air contained in the flue would be increased, and that with that increased volume the velocity of the current must increase in like proportion.

It had also been calculated that as the pressure diminished and the volume of the contained air increased its temperature must decrease; that at the outlet of the flue where the barometric pressure is approximately twenty inches when at the sea coast it is thirty, the volume and velocity of the current would

be to its volume and velocity at the entrance as three is to two, and that, conversely, the temperature at the summit must be to the temperature at the entrance as two is to three, or two-thirds of the seacoast temperature, and this calculation, too, was correct.

And yet the blast of air escaping from the outlet of the great flue was vastly colder than had been anticipated. Where was the error?

Simply this; the savants had not located the zero point of the thermometer in the right place. It had been recognized that the Fahrenheit thermometer in common use in the United States was arbitrary and unscientific; the centigrade thermometer, however, having its zero point at the freezing point of water and its hundredth degree at the boiling point, was assumed without question to be natural and scientific, and all calculations had been made with reference to that.

The centigrade thermometer *is* natural and scientific for water, as a water thermometer it is without reproach, but we are not fishes, air and not water is the fluid in which we live and to which our thermometric standards should apply. The true zero point of a thermometer is not the freezing point of water but the boiling point of air, and that, as we have previously had occasion to notice, is at minus 312 degrees Fahrenheit. Hence, when at the entrance to the great flue the temperature by the common thermometer is 80 in the shade, about the average daytime summer temperature, that temperature is, when scientifically stated in the same degrees, 392, and at the outlet of the flue, the air being neither warmed nor cooled, with the temperature unchanged except by expansion, under a pressure two-thirds of that at the entrance, the temperature will register two-thirds of 392, that is 261 1/3°. Translating this again to the Fahrenheit scale it reads minus

51 2/3°. That is the temperature of the atmosphere which under a barometric pressure of thirty inches reads 80° Fahrenheit, under a barometric pressure of only twenty inches reads 51 2/3° below zero. This sufficiently accounts for the arctic blast and the growing glacier at the mountain's top; it also throws light on the low temperatures prevailing at high altitudes. As a matter of fact, however, we do not in nature find temperatures so low as 51 2/3° below zero at twenty inches of barometric pressure, corresponding to 80° in the shade at thirty inches, and from this fact the statement of the old meteorologists that the sun's rays had very little heating power on the higher layers of the earth's atmosphere, but developed that power mostly on the earth's surface, has been reversed, and it is recognized that the sun's rays on the ocean of atmosphere that envelopes the earth, as truly as on the ocean of water, act most intensely on the superficial portion of it, and the deepest or lowest strata are really the coolest.

During the years spent in building the great flue the forces employed in building it were housed comfortably but temporarily in such manner as was found most convenient. Meanwhile the site laid out for the city of New Utopia had become a very beautiful as well as a very extensive park. Lying at the mountain's foot, there was in it enough of broken ground and rocky ravines to afford abundant opportunity for scenic effect, ranging from the most peaceful beauty to the wildest grandeur. By all the artists employed in the service and all the amateur talent which such an enterprise naturally enlisted, the site of the city of New Utopia had been treated as the canvas of a painter or the marble of a sculptor. Every suggestion tending to enhance the beauty of any part of the growing city, or to increase its convenience or the comfort or welfare of its inhabi-

tants, was given consideration, and out of the multitude of counselors came wisdom, for every idea of merit found champions, and the overwhelming influence of any single person was prevented. Slight errors had been made, but the deliberate method adopted, the plans of every building pictured in relation to its surroundings being open for public inspection for six months at least before its construction was begun, allowed such errors to be detected and corrected with the slightest of loss.

And now, among groves of thrifty young trees, and adorning the loveliest of vistas, groups of noble buildings have arisen. Great hotels or apartment houses are numerous, built with all the graces of architecture, providing for those that dwell in them all that could promote comfort or gratify good taste, all harmonious in the fitness of every part to its reasonable uses. In these buildings, served with every possible comfort or convenience, veterans are housed who have retired from the army on the completion of their fifty years of age.

Many of these buildings are connected by artistic corridors with each other, and with dining rooms, music halls and libraries, while all about them are lawns and groves, parterres of flowers and shrubbery, and curving ways along which course the silent motor carriages and bicycles flit to and fro.

In these great palaces every family and every inmate is provided with the strictest privacy as well as the conveniences of association, and the dignity and magnificence of habitation which could be attained in large buildings only.

But in due proportion, to give variety to the whole, to prevent the architectural merits of any building from being lost in a crowd of other buildings of equal size and equal excellence, as well as to suit the taste of such as prefer the seclusion of a house wholly their own, there are many small cottages,

little gems of art, so grouped and placed that their inmates may, equally with the inhabitants of the more pretentious buildings, enjoy every convenience of the public services, heating and cooling, for every apartment is furnished with cold air from the liquid air engines, lighting and water, dining halls, libraries and all other felicities which art could contrive or reason desire.

At every turn, down vistas giving all that could be wished in the way of foreground setting, whose only imperfection was the fact that all the trees were yet young, an imperfection that time and care would rapidly correct, distant views appeared, the beauty and grandeur of which could be equalled nowhere else on earth.

Yonder, a little to the east of north, is the great range of San Bernardino, crowned with its ever growing glacier, shining, glistening, golden white in its high lights, tinted with lilac on its snowy slopes, deepening into purple and indigo and ultra-marine in its shadows, capped with its heaped up cloud of driving snow where the great flue is pouring out its arctic blast; that cloud itself in its cumulous mass shining and tinted with lights and colors comparable only to those on the visible glacier, but ever changing in form and features; the base of the great glacier edged about with dark based clouds where the warmth of the plain and the frost of the glacier meet, seeming to lift the shining glacier and its cap of shining cloud high into the sky, while dark beneath this cloudy canopy the base of the mountain appears in the deepest of purple.

This alternation of mountain base, cloud, and glacier, exaggerates to the eye the altitude of the range, producing an appearance of loftiness which Chimborazo or the Himalayas can scarcely equal. The brilliant display of colors is an atmospheric effect peculiar to these semi-arid regions, developed by

distance, and changing with the season, the weather, and the time of the day. Between the eye and this glorious mountain, and stretching across the plain from the north to the west and the southwest, the great flue is seen. The eye ranges over its surface toward the west and southwest where it appears, broken by the sag of its suspension cables into waves like the waves of the sea, but such waves were never seen on any sea, being a quarter of a mile from crest to crest and two hundred and fifty feet high from the trough to the foaming comb, for the shining white of the aluminum caps of the towers simulate the appearance of a foaming wave crest to perfection. Below this wave covered expanse, and toward the north along the higher portion of the flue's extent, rising between that expanse and the eye, stretches the cliff-like wall of the flue, broken by the tracery of the external portions of the supporting towers, softened into mellowness by the distance. The whole mighty structure appears to taper out as it recedes in the distance, passing through the cloud canopy about the middle height of the mountain yonder up and up to the shining cloud that caps the shining glacier.

On the other hand, toward the west, where the wave spread expanse of the roof of the great flue opens out like the sea, over all is seen the shining waters of the Pacific Ocean, with the dark masses of the Santa Ana hills rising like an island above the waves on the right.

Further toward the south the swelling foothills of the San Jacinto group, now clothed with forests, sink away to the sea, while from the south, round by the east to the northeast, the nearer masses of the San Jacinto mountains, seamed with canyons buttressed with towering cliffs, bristling with rocky pinnacles, swell up toward the sky.

The slopes and swelling shoulders of these mountains are now clothed and beautified with groves of trees and thick growing shrubbery, interspersed with openings, on which the semitropical growths native to the mountains of this region display their characteristic forms. On these terraced shoulders, lifted above the spires of somber pine thrust up from dark gulches beneath, are nodding groves of plumy palms. Yonder frowning battlements are bristling with the stiff, sharp-pointed blades of the Spanish bayonet, yucca grandiflora, each leaf of which is capable of serving as a bayonet in fact, and the branching palmeas of the Mexicans, each growing point of which is a bunch of long sedge-like blades at the end of a pole, with a long panicle springing from its heart which in its season is filled with innumerable delicate greenish yellow flowers. And the prickly pear cactus finds its home there, covering rocky ledges in the spring with yellow roses, every rose of which has its many thorns and great. And there are acacia bushes of many kinds, some flaming with brilliant flowers of scarlet and orange in their season, and there are clustering shrubs, smooth leaved and smooth stemmed, which bear through the summer clustering racemes of large, trumpet-shaped yellow flowers, sweet scented and lined in their throats with delicate stripes of satiny brown. And about the lower slopes the rocks and shrubs are thickly tangled with climbing vines which all through the summer are filled with masses of brilliant rose-colored flowers in drooping racemes; these are straying varieties found here that have their habitat more especially farther south in the Mexican uplands, but here their presence gives greater variety to the numberless other flowers for which California is noted.

The verdure of these northern and northwestern aspects of the mountains in these latitudes is naturally greater than

that of their southern faces, and here it has been greatly increased by the protection which it has had in recent years from browsing cattle, and by the retention of the water in the ravines, so that now every rocky cliff is fringed with green. Over the brims of yawning chasms peep the tops of mountain pines, and groves of oak with their leaves all fresh and green through the winter months cover the slopes, while here and there along the ravines and among the crags of precipitous ledges the feathery plumes of the mountain bamboo crowd thick and close, and we have the luxuriance of the tropics mingled with the flora and sylva of the north.

Such are the scenes that form the background visible from every part of New Utopia, now appearing through a lovely vista, now disappearing behind some nearer scene of beauty or magnificence, changing with every change of position.

In the country lying round about the desert is vanishing.

The great rain flue has proved a great snow flue, rather, but it has served its purpose the better for that reason. Before the great flue was completed, the San Bernardino range had been girdled with a great intercepting canal just above the three thousand feet contour line, with receiving basins in all the ravines above. This canal is built in the strongest manner possible; at every point where a break might possibly occur it is of solid masonry laid in cement. Beginning at the southwest side of the great peak, just above Redlands, and passing under the great flue, this canal skirts along the mountain toward the southeast with a fall of three feet to the mile; passing over the plateau in which the mountains terminate at the southeastern extremity of the range, it continues its course back toward the northwest along the north side of the range. Just across the mountains from the point of starting, where the ravine formerly known as Deep creek is reached, a great

basin has been constructed of enormous strength and depth, and this valley is now occupied by a lake, quite small in area, but ample to regulate the flow of water into the system of canals and aqueducts which take their departure from this point to water the plain over which the deadly Mohave desert has spread for unnumbered ages. And for this purpose there is water enough, and enough is drawn from the girdling canal to water all the valley between the San Bernardino and the San Jacinto mountains, and to make meadows and gardens of all the slopes down to the borders of Lake Diaz.

And the upper atmosphere being chilled by the glacier and by the arctic blast from which the glacier springs, the rainfall in the San Jacinto mountains has doubled, and every height from Mexico to Montana registers an increase. The new planted forests play their part in promoting this humidity, especially by retaining it on the heights in the sponge of their fallen leaves until it percolates into the earth; and as a consequence, new springs are appearing everywhere, and the arid region has passed away to be known no more, so long as man shall lend nature his assistance to beautify the earth and perfect it.

Yet it is not by rains and showers that this increased humidity is distributed. For ten months of the year, over all the lower plains of this formerly arid region, almost no rain falls, and if water were not conveyed to the fields through the irrigating mains every crop would perish and every vine and fruit tree would die.

CHAPTER XXII.

But we have departed from our survey of New Utopia, in order to glance at the changes that have occurred in the country round about.

Let us return. When we wander among the groves and pavilions that now adorn the shoulders and terraces of the San Jacinto mountains, to which we may climb or ride as suits our pleasure, from whence the New Utopians, and all who come and go, look down on the earth and the ocean and the glories thereof, along the borders of their dark abysses, rendered darker and deeper to the eye by the thickets of pine rooted in their crevices, that thrust up their sombre spires toward our feet, or along the railed edges of frowning precipices from which we watch the birds sailing away beneath us, we may remember that "the earth is hollow where we tread, although it gives no sound."

Let us survey the catacombs, in the deep recesses of which the storehouses and the granaries and the power works of New Utopia are all hidden away.

Applying at the office of the custodian of stores for a guide, a man is sent with us, and we are led to one of the main entrances of the catacombs. This great entrance, sixty feet high and sixty feet wide, is now built up into an artistic portal crowned with a massive coping wall to protect the approach from anything which might slide down the mountain from above. At either side of this portal rises a tall column with its base and capital artistically proportioned. Above, a graceful arch springs across, its crown rising nearly to the top of the gallery within. The keystone and bases of this arch are carved with appropriate figures in high relief.

Level with the bases of the capitals of the columns, thirty-three feet above the floor of the entrance, an enamelled metallic moulding stretches across, behind which runs a track for sliding doors. These doors are thirty-three feet high and each fifteen feet wide; the recesses into which they slide are paneled and ornamented with figures in relief adapted from mythology, appropriate to the uses for which the chambers within are designed. The doors themselves, which are of enamelled aluminum, are appropriately ornamented in flat relief.

The space within the arch above the doors is filled with a stained glass window, in sections radiating like the petals of a sunflower whose perimeter corresponds with the curve of the arch. The central petal is adorned with the traditional sheaf, while the figures in the stained glass of the rest of the window are of fruits and foliage, so arranged as to produce a very pleasing and artistic effect.

In the pavement, passing under the doors, is a double railway track.

Our guide, stepping to a post by the wayside, touches a button, and the doors slide noiselessly back into their recesses. Passing within, another button is pressed and the doors as quietly close behind us.

The first part of the chamber within is flooded with light from the stained glass window, but in the gloom beyond we see a line of brilliant electric lights each suspended under the groined arch formed by the crossing of a gallery transverse to the one we have entered and along which we are looking, they fade away in the remote recesses of the catacombs to imperceptible points in the dim distance, like the remote lights on a long street in a well lighted city.

As we pass along, similar lines appear on the right and left on the cross streets, and in the pavement at our feet is a double

track of steel as if for street cars, but overhead is nothing but the interminable succession of rough arches of the quarried rock.

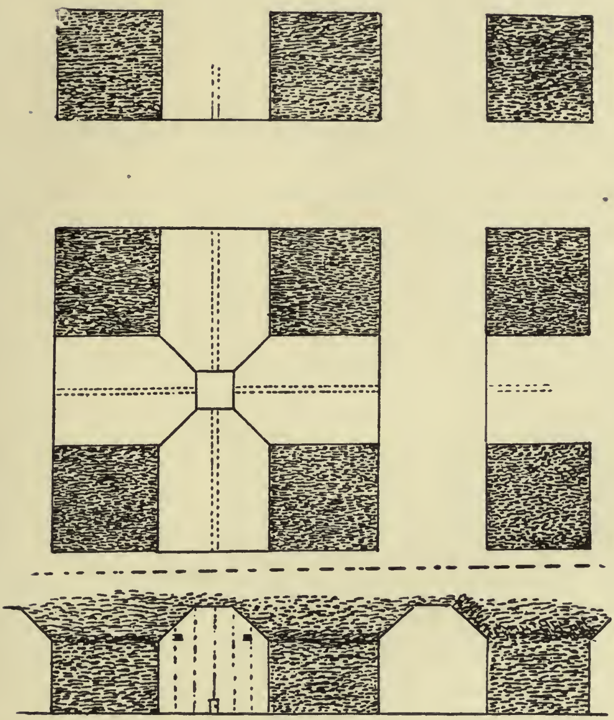
After passing the second block, we discover that alternate passages are walled up in such a manner as to convert them into chambers, each of which is in the form of a Greek cross, like the nave and transept of some ancient cathedral. Each such chamber may be regarded as composed of five separate square parts, each sixty by sixty feet in dimensions.

These are the storage chambers, each of which is fitted up to suit the purpose for which it is used, whatever that purpose may be.

Our guide touches a button and a door of ordinary size slides open and admits us into a passage within one of these walled off chambers.

This passage is barely four feet wide by seven feet high, enclosed on the right and left and overhead with galvanized iron.

This passage leads directly to the center of the block, where it opens into a chamber of galvanized iron twenty feet square, with walls forty feet high. A similar passage opens into this chamber on each of its four sides; in its center is a spiral stairway surmounted by a platform fifty feet above the floor, that is within ten feet of the roof, and above this platform an electric light is suspended. We mount to this platform and perceive that the four wings of this block, together with all the central part except the pit through which we have entered, has been converted into bins, whose floors and sides are lined with galvanized iron, to keep the contents of the bin from the wall of rock. The bottom of each of these great bins slopes toward the outer front, where a line of elevators, corresponding with a similar line on the outside, serves to remove



THE CATACOMBS— NEW UTOPIA

PLAN & SECTION.

the grain and load it on cars outside, or working the other way, to remove it from cars and fill the bin very quickly. This machinery, of course, is operated by electric power.

We notice that, rising from the floor of these bins to the level of their top, that is forty feet, are rows of vertical rods or pipes linked together at the top like the pipes in steam radiators.

Our guide explains that these pipes connect with the exhaust from the liquid air engines. "We can," he said "reduce the temperature of the contents of any of these bins when filled, within an hour, to 200 below zero, or much colder if desired. Of course, no living thing can long survive in such a temperature. With this arrangement we need fear no weevil, nor rats nor mice either. But," he continued, "wheat that has been long subjected to these extreme cold temperatures will not grow. Of course, every seed capable of growth is a living thing. Dry seeds, like wheat, will bear cold that nothing with animal life in it can survive, even the temperature of liquid air for a while, but if long continued this extreme cold is as destructive to the vitality of seeds as heat would be if we should roast our grain brown. It doesn't hurt the grain, however, for food, if it is kept at 300 below zero for any length of time."

"But how about your seed grain?" we ask. "Oh, yes; this granary is so excellent that seed wheat from all the irrigated region is sent here for storage. We have four or five millions of bushels of it stored here every season. It will stand a pretty wide range of temperature, as everybody knows, enough so to permit us to protect it from vermin, but we don't freeze it to death, of course. The natural temperature of these chambers is about 65 Fahrenheit the year round, but we find that the vitality of seed wheat is stronger and will last longer if the grain in storage is kept at a temperature of from 36 to

40° from the time of harvesting to the sowing, and it costs nothing to regulate the storage bins to that temperature. The same temperature is right for keeping apples, potatoes and most articles which need to be kept cool without being frozen. We have in these chambers a hundred blocks fitted up for the preservation of fruit, potatoes, and vegetables, under cold storage, and as many others for the preservation of fresh and salt meats, of which we keep the former frozen hard. Everything that would tend to mar the beauty of the external world which can be adapted to these chambers we do here, but their capacity is not one-half utilized."

But we will return to the sunlight.

New Utopia, of course, has some industries that can not be carried on in the catacombs; for instance, the live stock department.

Without fresh milk and butter, no possible beauty of surroundings could make life wholly satisfactory to the people, and accordingly there is a dairy establishment here of sufficient magnitude to supply all present needs and capable of indefinite enlargement.

The barns and exercising ranges here, and the system of caring for the cows, being a repetition of the same in Fort Goodwill, need not be described. They are situated on the divide, some fifteen miles northeast of New Utopia center, that is five miles beyond the border of New Utopia at the canyon of the San Jacinto river, for the city park covers the whole plateau above the two thousand feet level from the San Jacinto river to Coahuila creek, about twenty miles by fifteen.

The fertilizer works, the sewage evaporating reservoirs, and all lines of industry naturally associated with these are ten miles farther, being below the 2,000 feet level on the east side

of the divide. It is only a thirty minutes run, however, to reach this point from the city center on the electric railway.

The great intercepting sewer, which with its accompanying subway was the first work undertaken toward building the city of New Utopia, has its outfall basin just across the canyon of the San Jacinto river over which it is carried on a beautiful bridge. From this basin the sewerage is lifted by pumping works about 150 feet to enable it to flow across the divide to the eastward, the conduit which carries it serving the needs of the dairy and stock district and the outlying industries in its course. The hundred and fifty square miles or thereabouts of nearly level land that constitutes the divide and its eastern slope down to the 1,000 foot level, excepting so much of it as is occupied by the dairy and live stock district and the industries mentioned, is put under power after the manner of the Fort Goodwill and Mount Ceres agricultural districts in order to devote it to grain and forage plants for the stock.

Below the 1,000 foot level on this eastern side of the divide, down to the margin of Lake Diaz, the land is planted with oranges and other tropical fruits. There are localities here suited to the cultivation of bananas and even pineapples, and of malaga grapes and other delicate and subtropical varieties there are extensive vineyards.

It is intended to produce here as much of this class of fruits as the entire population of the irrigated lands can consume, and perhaps a considerable excess for the world at large, while of apples and other northern fruits the Fort Goodwill district will produce enough for all, and the Mount Ceres district will provide the peaches, pears and northern grapes. The grain and forage fields of this district can, of course, be reinforced to any extent needed from the desert lands lying north of the San Bernardino range.

The territory lying west of the great flue is not in the domain of New Utopia, being reserved for San Bernardino, Redlands, Los Angeles, and the older towns and cities.

The land lying between New Utopia and the foot of the great flue, also the western face of the San Jacinto mountains, and from their foot to the sea, being rugged, is devoted to timber and the landscape art.

CHAPTER XXIII.

On the completion of the great flue and the girdling canal of the San Bernardino mountains, there remained of non-productive public works only the normal extension of irrigation, roads, and forestry, with such building as the people might wish. At the same time the output of the iron works at Fort Goodwill and of the glass works at Vitre shrank to less than one-quarter of their former proportions, and that of the glass works especially assumed a totally different character.

This released a great army of men from the employments in which they had hitherto been engaged.

To partially offset this, the force of teachers in the schools and lecturers in the public educational courses was at this time greatly increased, and the lecture courses were extended into new fields and greatly diversified.

It was, however, found practicable again to reduce the number of hours of required service, this time from six to four hours per day, at which limit it has since remained fixed.

It should be remembered that New Utopia, being especially designed as a home for those retired from active service at the age of fifty years, was in larger proportion than other places peopled by these veterans, who in fact constituted about half the population of the city.

Not only these, however, but all who had for a series of years been employed in the service were now trained to a high grade of mental activity and were prepared to use wisely and enjoy the large increase of leisure which was now at their disposal.

Nothing can give a better birdseye view of life in New Utopia than an extract from a copy of "The Daily Bulletin and Visitors' Guide," which we give as follows:

EDUCATIONAL.

Lectures in the higher courses. (All are invited).

PHYSICS.

At School Hall No. 3, 10:30 A. M.
At School Hall No. 27, 2:30 P. M.
At School Hall No. 17, 4 P. M.
At School Hall No. 48, 10 A. M.

CHEMISTRY.

At School Hall No. 7, 10:30 A. M.
At School Hall No. 32, 2:30 P. M.
At School Hall No. 39, 4 P. M.
At School Hall No. 5, 2:30 P. M.

GEOLOGY AND PLANETARY EVOLUTION.

At School Hall No. 1, 10:30 A. M.
At School Hall No. 10, 2:30 P. M.
At School Hall No. 22, 10:30 A. M.
At School Hall No. 56, 4 P. M.

BOTANY.

At School Hall No. 2, 10:30 A. M.
At School Hall No. 13, 2:30 P. M.
At School Hall No. 24, 4 P. M.
At Pavilion in Botanical Gardens at 4 P. M.

ZOOLOGY.

At School Hall No. 4, 10:30 A. M.
At Zoological Park Pavilion, 4 P. M.

PHYSIOLOGY AND HEALTH.

At School Hall No. 11, 10:30 A. M.
At School Hall No. 20, 2 P. M.
At School Hall No. 44, 4 P. M.
At School Hall No. 36, 2 P. M.

LANGUAGE AND THE ART OF EXPRESSION.

At School Hall No. 12, 10:30 A. M.
At School Hall No. 54, 2:30 P. M.

LITERATURE.

At School Hall No. 19, 10 A. M.
At School Hall No. 47, 2 P. M.
At School Hall No. 31, 4 P. M.

GEOGRAPHY.

At School Hall No. 1, 2 P. M.
At School Hall No. 15, 10 A. M.
At School Hall No. 22, 4 P. M.
At School Hall No. 50, 2 P. M.

FINE ARTS.

Perspective and Projections—At School Hall No. 9, 10 A. M.
The Harmony and Discord of Color—School Hall No. 25, 2 P. M.
The Human Figure in Action and Repose—School Hall No. 30, 4 P. M.
Sculpture, Modeling—At the Central Gallery of Arts, 10 A. M.

ARCHITECTURE.

At School Hall No. 8, 10 A. M.
At School Hall No. 36, 2 P. M.
At School Hall No. 52, 10 A. M.

HISTORY AND SOCIAL EVOLUTION.

At School Hall No. 6, 10:30 A. M.
At School Hall No. 2, 2 P. M.
At School Hall No. 14, 4 P. M.
At School Hall No. 42, 10:30 A. M.

THE LOGIC OF MATHEMATICS.

At School Hall No. 14, 10 A. M.
At School Hall No. 7, 2 P. M.

ASTRONOMY AND COSMOLOGY.

At School Hall No. 12, 10:30 A. M.
At School Hall No. 21, 2 P. M.
At School Hall No. 33, 4 P. M.
At School Hall No. 54, 10:30 A. M.

PHILOSOPHY AND PSYCHOLOGY.

At School Hall No. 18, 10 A. M.
At School Hall No. 45, 2 P. M.
At School Hall No. 34, 10 A. M.
At School Hall No. 3, 2 P. M.

ETHICS AND CAUSATION.

At School Hall No. 16, 10 A. M.
At School Hall No. 26, 2 P. M.
At School Hall No. 40, 4 P. M.
At School Hall No. 56, 10:30 A. M.

SPIRITUAL PHILOSOPHY.

At School Hall No. 20, 10:30 A. M.
At School Hall No. 46, 2 P. M.
At School Hall No. 28, 4 P. M.

THE PEOPLE'S FORUM.

At City Hall from 7:30 to 9:30 P. M. daily.

All suggestions which may have been dropped in the boxes through the day, proposing any changes or improvements, are read and discussed. If by three or more deemed desirable to be adopted, they are booked for further consideration. Topics thus laid over from former meetings are debated, and any proposition pronounced worthy of adoption by a majority vote of those present is referred to the public committee in charge of the department in which it would fall, to be presented to the people, with such suggestions as the experience of the committee would council, for their decision whether it shall be carried into effect or not.

RECREATIONS.

For tomorrow, September 18th.

An equestrian excursion in the San Jacinto mountains. More than 1,500 will participate. Lunch will be served at 12:30, on the plateau of Mount La Salle, overlooking the Pacific. Starts at 9 a. m. Apply for horse today at the office of Department of Sports and Recreations.

Yachting and bathing party to Lake Diaz, with clam bake lunch in grove at the beach at 1 p. m. Starts at 9:30. Trolley cars.

Excursions by trolley cars on great flue every half hour daily.

Athletic games and races. Toboggan slides. Swings and merry-go-rounds for the children. With music. Athletic park, daily, 9 a. m. to 4 p. m.

An excursion to the ocean beach at south foot of great flue, conducted by Prof. X. of Marine Zoology and Botany. Lunch will be served at the proper time. Trolley cars. Starts at 10 a. .m.

Evening: Theaters, concerts, and lectures, in all parts of the city.

Public dining rooms, of which there are more than three hundred in New Utopia, are all built with the utmost regard for beauty and convenience, with family alcoves for those who desire them; they are ornate with palms and tropical plants, adorned with the finest works of art, and served with music. The food is served and dishes are removed by automatic waiters. You touch the button which signals to the kitchen what you desire, and directly it rises through the table before you. You place your dishes on a panel of the table, push another button, and they are instantly removed by the same hidden path.

When for any reason people prefer to take their meals in their own houses, pneumatic service tubes convey food and dishes to and from them in like manner.

A trace of militarism remains in the custom which prevails in New Utopia every morning to awaken the city with a musical reveille.

A modification of the organ has been invented for this use, which combines volume of sound with softness of tone, and which is accompanied with chimes of bells. These instruments are placed in the cupolas and towers of every public building, and an assortment of music appropriate to every occasion condition and time of the year is provided for their use. By an automatic electrical device the music can be played simultaneously on each and all of these instruments by a single musician operating the central instrument, all the niceties of touch and modulation being perfectly transmitted to every

instrument connected. The result is that every part of the city, near and remote, is permeated with the music. Often the people, growing accustomed to it, are not aware that they hear, yet the fact remains, as experience has long since demonstrated, that the mode and temper of the people are greatly harmonized and sweetened by the influence of such music, even though it may be unconsciously heard. Of course the use of these instruments is not limited to the morning reveille; at noonday and sunset, also, melodies are sounded, and on every public occasion, festivity or funeral of special note, appropriate music sounds throughout the city.

In the course of reforms and changes so sweeping as those which have attended the history here recited, it would have been strange if the funeral customs which had prevailed in the civilized world for ages had not been changed also.

It was early in the summer of 1920 that the following document, signed by General Theodore Goodwill and nearly all the general and regimental officers under his command, was promulgated:

"Fellow soldiers and citizen tenantry: The topic of this communication lying outside of the field of our prescribed operations, we address you as equals, making to you a proposition which you are free to accept or reject, and regarding which your actions in either case must be according to your voluntary choice.

"From our youth to this time, we, the initial signers of this paper, have been impressed with the futility of the burial customs prevailing among the European nations from prehistoric times.

"In order that the memory of the dead may be preserved among the living, tombstones are erected over their graves, and when, through the departure of relatives and friends of the

dead from the vicinity, or for any other reason, these monuments fall into neglect, they perish before the living by whose hand they were planted pass into the beyond.

"At a great waste of energy and expense our landscapes and gardens are made lugubrious, and the purpose for which this is done is not accomplished. A cemetery lot is purchased in which to bury the dead on the theory that the six feet by three of earth occupied by the grave shall remain sacred to the dead for their sole occupancy forever.

"Yet a little thought must show the absurdity of the idea. If such titles continued to be respected, but a few generations could pass before the earth would be devoted to the dead alone and the living must be crowded off its face. If they had been respected since these funeral customs have prevailed, every acre of land on the habitable earth would long since have become a graveyard, and there would be no place on the planet for the living.

"And yet the purpose sought by these funeral customs is one which in the present state of science and art is easy to attain. It is now possible to preserve the records and even the likeness of the dead in such a manner that they shall remain uninjured and accessible to the living to the remotest future.

"The desire that one's memory or the records of his life shall remain among the living after he has passed from earth is natural to man and not to be condemned, and that this desire may be fulfilled and the records of each one's life, who cares to make the arrangements necessary to that end, shall be preserved to the remotest posterity is the object of the society which it is hereby proposed to organize.

"To this end we, the undersigned, hereby mutually bind ourselves to fit up in an imperishable manner a suitable chamber, or chambers, in which shall be filed away the records of

each of our lives, with photographs of our persons, and copies of any books or writings which we may have written, or any other matter which by our surviving relatives may be deemed necessary to a just and perfect record of the person who has passed away; the whole to be prepared in the most imperishable manner and filed away in order in its year, and indexed with reference to the records of other members of his family or his immediate ancestors who have passed before him.

"We bind ourselves, also, to abandon the custom of burial for our bodies and to submit them to decomposition by combustion until all volatile or combustible constituents thereof shall have been decomposed into their ultimate elements and dissipated into the air, and the remaining earthy substances reduced to powder shall be restored to the earth whence they were derived.

"For the purpose of building and equipping in a suitable manner the chambers necessary for the preservation of the records of the dead, and the crematoriums for the decomposition of their bodies as herein prescribed, we bind ourselves to contribute one day's labor, more or less, as may be required."

Signed, Theodore Goodwill, and others.

This proposition proved more popular than had been anticipated. It was signed at sight by more than half of the army and by nearly half of the citizen tenantry, and after its institutions had become established there was a rapid drift into the society of those who at first had hesitated to break away from the customs of their ancestors, until those who adhered to the ancient funeral custom were a mere remnant and survival of an obsolete rule.

Suitable provisions for carrying out the purposes of this society were immediately made in every permanent place of habitation throughout the government domain. At New

Utopia a choice crossed chamber in the catacombs was fitted up just within the southwest entrance, where the external surroundings were most convenient and suitable for the solemnization of funerals, and in a part of the catacombs far removed from any appropriated to other uses. The sides and walls of this chamber were covered with white enamel, its ceiling tinted with blue, and its floor inlaid with tile appropriate to the uses for which the chamber was designed. The walls were then fitted with strong drawers capable of sliding out to give access to the records, but not easily removed from their places; each such drawer was numbered and provided with blank spaces for the dates between which it should serve, while on the floor were two lines of glass-covered cases in which the index was arranged like the card index of a library.

Over the entrance door of this chamber on a tablet of granite was chiseled these words:

"SACRED TO THE MEMORY OF THOSE WHO HAVE PASSED INTO THE HIGHER LIFE.
Dedicated June 21, 1920."

The crematorium was built in the midst of a grove of pines just above this gate of the dead into these catacombs. Here, without the appearance of fire, the bodies of the dead are consumed by electricity in the presence of liquid air while the obsequies of the departed are in progress.

After the decomposition of the body is completed, the master of ceremonies, to the ancient ritual of "ashes to ashes and dust to dust," sifts the ashes of the dead into an opening in the top of an altar, whence they pass into a pneumatic tube and are whisked away beyond the divide to the eastward to where the dust of the city is collected and where phosphate of lime finds its appropriate uses.

For the use of the remnant of people who still adhere to the ancient custom of burial, a mortuary park is provided; this is situated on a terrace of the western foot of the San Jacinto mountains, a little to the southward of the city and below the two thousand foot level, but the demand for its use for cemetery purposes is very small and growing smaller year by year.

CHAPTER XXIV.

With the male population between the ages of twenty-one and fifty years taxed but four hours per day in the public services, and the women but two hours, the whole population were now enjoying life in wealth and security. The people of the national domain which had been reclaimed from the desert now lived mostly in large towns, with smaller villages serving as temporary camps for their employment in distant services.

The army, so much of it as remained unabsorbed in the citizen tenantry, was housed and employed like the rest.

In accordance with an act of congress passed during the session following the completion of the great flue, the war department of the United States was transformed into the department of civil industries and public works, whose duties it should be to direct the reciprocal co-ordination of industries and their products between the municipalities of the United States, under whose direct charge they were to be conducted.

Under the regulation of this arm of the government, arrangements were made for transferring all localized public works that had been built under the military regime to the charge of the municipalities that had grown up with them, and through a subordinate branch of this department of the government, the division of transportation and communication, passengers, freight, express packages, the postal service, telegraphs, and long distance telephones, were systematized and perfected.

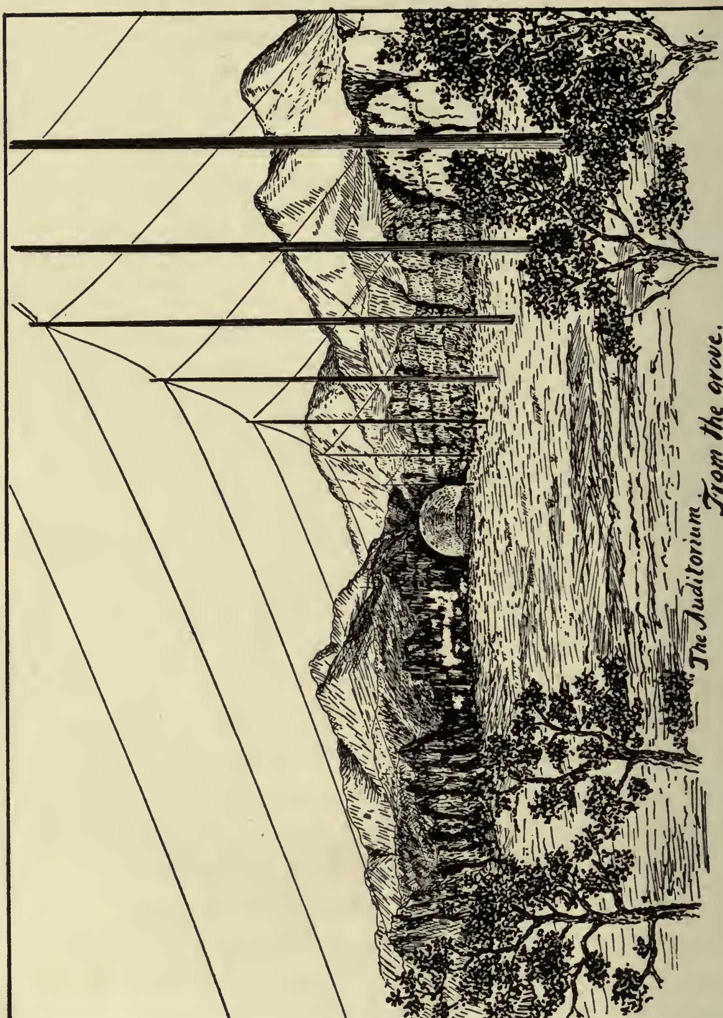
Arrangements were made for the final disbandment of the army at a grand celebration of the fourth of July of the year

1929, to be held at a suitable place high in the San Jacinto mountains above the city of New Utopia.

For this purpose a rocky glade was chosen that forms a natural amphitheater a little above the 6,000 feet level, and preparatory to the occasion, four distinct lines of double tracked inclined plane railways were built up the mountain to the terrace that fronts this amphitheater, and also four lines of continuous elevators, similar to those used in the shafts of deep mines, were constructed in shafts excavated from the catacombs beneath.

This auditorium covers about 100 acres and opens on a plateau as large again, which is well wooded with oak, and from the margin of which the eye ranges broadly over the Pacific ocean, the southern part of the city of New Utopia, and the lower part of the great flue, with the Santa Ana group of hills behind, over the tops of which the water of the ocean can be seen.

The margins of this amphitheater are formed by precipitous rocky walls from 75 to 200 feet high, which converge at the upper extremity of the glade, meeting at a point where, during rains, a stream of water, after a series of cascades, leaps over a precipice 75 feet high, but which at all other times is dry. This valley, below this precipice, is one of those in which a filtering tunnel had been constructed during the first season's operations in this region, and in covering this tunnel the shallow ravine along which it was laid was entirely filled with broken stone and gravel, so that the floor of the valley now required but little work to fit it for seating the immense audience which was to fill it. At the head of this valley, just beneath the dry cascade, a stand was built for the speakers and canopied over with a sounding board of wood in the form of a parabolic reflector with the speakers' stand in its focus.



The Auditorium. From the grove.

Along the middle line of this valley, from the speakers' stand to the oak grove on the terrace fronting it, a series of iron masts were erected high enough to overtop the rock walls of the valley and give a good slant to the stay cables which were stretched from these mast heads to their anchorages above and beyond these walls. A similar cable was also stretched like a ridge pole from the rocks above the cascade behind the speakers' stand to the mast heads of the whole series and thence to an anchorage on the terrace in front, thus forming a tent frame covering the entire glade. To this cable and to the rings about the mast heads to which the side stays were attached, pulleys were fixed, which, when the time came for the celebration, served to pull rolls of canvas into place and enclose the whole valley as a tent with a ventilating space left open above the rock walls all round the margin.

Under this canopy the entire glade was covered with seats to accommodate the 500,000 people or more who were expected to be present. The rocky walls of this natural auditorium, together with the sounding-board reflector, would of themselves transmit the voice of a speaker to a great distance, but within the distance at which there might be a chance that a speaker's voice might begin to be indistinct a circle of perfected auditorium telephones were erected, their transmitting pieces being in the overarching edge of the sounding board over the speakers' stand. Behind this row of telephones, at a proper distance, was another and still another, until, by actual experiment, every word uttered on the speakers' stand, though in a low tone, could be distinctly heard in the remotest seat, or any other seat, of that vast auditorium.

In the grove outside, tables were set and refreshments provided to furnish two meals for the hungry multitude expected,

while grove and auditorium alike were gay with flags, and everything was fitted to accord with the spirit of the occasion.

At nine o'clock on the morning of this greatest of celebrations the inclined railways and the elevator shafts began to pour the multitude into the grove, where for an hour they wandered at their pleasure.

At ten the orchestra for the occasion arrived, and, with salvos of noisy artillery, stationed near by, to break the intervals, they discoursed music to the multitude until noon.

Then came the first meal; the tables were spread for 500,000 and filled, and there was an overflow of some 3,500 to be provided for at a second serving. The meal being finished, after another salvo of artillery the people fell into lines and were marshaled into the great auditorium to the music of the Star Spangled Banner.

Following the multitude, the army marched in and occupied seats reserved for it in front, the music continuing meanwhile.

Then, at a signal, the mighty audience rose and joined in singing the national anthem, after which Colonel M. of the educational department stepped to the front of the speakers' stand, and with his fine voice and expressive rendering read the old Declaration of Independence.

Another hush and an appropriate interlude by the orchestra, and General Theodore Goodwill stepped to the front and delivered the following address.

"Fellow citizens and soldiers of the army of industry:

"One hundred and fifty-four years ago this day, the immortal document to which we have just listened was first proclaimed to the nations of the earth. That declaration was a herald of the future, the forerunner of a new order of things which did not then exist, and which in the nature of things

could not exist until the competitive and commercial order of society, which at that time had hardly blossomed, had brought forth its fruit, and ripened it, and passed away.

" 'We hold these truths to be self evident,' says that immortal Declaration, 'that all men are created equal; that they are endowed by their creator with certain inalienable rights; that among these are life, liberty and the pursuit of happiness; that to secure these rights governments are instituted among men, deriving their just powers from the consent of the governed; that whenever any form of government becomes destructive of these ends, it is the right of the people to alter or abolish it and to institute a new government, laying its foundations on such principles and organizing its powers in such form as to them shall seem most likely to effect their safety and happiness.'

"Glorious was the declaration with truth inspired, but the time for its realization was not ripe.

"Equality was not, and without equality life and liberty were in eternal jeopardy, and the pursuit of happiness was a mockery, a rainbow chase after the unattainable and impossible.

"Unto thy neighbor as thyself, was, is, and forever must be, the fundamental condition without which the welfare of any community is impossible, and of any individual is insecure.

"To think of a community as prospering while a large proportion of its individual members suffer from poverty and dependence and oppression, is an absurdity on its face, though from the beginning of history until our own time the world has refused to see the absurdity of it.

"The destruction which overwhelms some must endanger all. He that diggeth a pit for his neighbor's feet, himself shall fall therein; he who would create a hell for his neighbor, him-

self must dwell therein. 'The measure ye mete shall be measured to you again.'

"The fundamental law which God enacted for the government of mankind is the law of cause and effect, and that law is as righteous as it is universal and eternal.

"Who is there but would wish that the conditions of his life should be the best that he can think of? Who would not prefer that his environment should be heavenly in its qualities? No sane man or woman.

"Very well; then let us make our world such as we would have it.

"The great architect of the universe has built its foundations fain; he has animated it with infinite forces, and now, as soon as our character as a race is sufficiently perfected to trust us with them, we are led into the knowledge how to harness these forces and use them in our service. Even yet the danger is that like an infant or an idiot playing with dynamite we may use these mighty forces to our mutual destruction.

"Let us always remember the rule, unto thy neighbor as unto thyself; and if anyone is not disposed to admit the rule in that shape, let him remember it in the converse as God's law of cause and effect will enforce it, unto thyself it shall be as unto thy neighbor.

"So long as the world made it the chief and only honorable business of men to live at each other's expense, to exact profit and tribute of each other and mutually eat each other up, it could not possibly be otherwise than that they should be mutually eaten up by each other.

"Whosoever would make his neighbor subordinate to himself, whoever would make another his servant, he would again build up among you those two reciprocal evils, despotism and slavery.

"Whoever seeks for himself or for any individual privileges not open to all; whoever seeks for himself or for any individual private ownership of anything for which an individual can have no private exclusive use, count that man an enemy. There is no motive possible among men that can cause anyone to desire such ownership, except the desire to oppress, or dominate over, the many who must use that which he would own.

"So long, however, as through your public organization you hold all privileges open to all alike, and through your public services, publicly owned and operated, at the least possible expenditure provide all things useful for the service of all, you need fear no such enemy.

"Yet it is well that you should know him and recognize his quality; could he but persuade the community to abdicate some needful function to him, he has wrought your ruin.

"But there will be ambitious ones among you, some whose souls will not rest unless they can shine among others, admired and honored and distinguished above the multitude. Every one who is spurred by this impulse, unless the prick that goads him is a disease that must for the common good be put under restraint, has individuality that will enable him to do something for the community or the world that shall be distinctly the tribute of his own personality, something that he can do but no other could. Let such a one strive to render to the world his tribute; let him exercise the power which is in him to give, not to get.

" 'It is more blessed to give than to receive.' 'Ye know that the rulers of the Gentiles lord it over them, and their great ones exercise authority over them, but it shall not be so among you. Whosoever would be great, let him render service to all;" whosoever desires to be honored, let him volunteer to render

the service which is most arduous, that is fraught with danger when danger shall arise; let him emulate Napoleon's soldiers, who vied with each other to win at the cannon's mouth the cross of the legion of honor, and dared death for the plaudits of their fellows. But your service will be to bless and save, where theirs was to kill and to destroy.

"Obeying this rule, honor shall go to those who are honorable, and praise to the praiseworthy, and 'the righteous shall shine forth as the sun.'

"Here today, with that justice which the Declaration of Independence proclaimed for the first time in the world's history an accomplished fact, we meet to celebrate that immortal declaration.

"In all this land there is now not one in want nor in danger of want, not one who is subordinate to any other one, nor in danger of such subjection.

"In the midst of the overflowing abundance with which today we are blessed, greed would be insanity, obviously so in the eyes of all men.

"Greed is the offspring of need; scarcity is the breath of its life. A world in which need and greed reign supreme is a hell in which all manner of evils find their congenial habitat.

"And yet, throughout all history until now, need born of ignorance, established in custom, and perpetuated by law, has prevailed throughout this world of ours, and, springing from this need, greed has dominated over it.

"Plant it as carefully as they would, tend it with all the love and longing that a bright ideal could inspire, yet in an atmosphere of need and greed the tree of liberty sickened and died.

"See to it that, with the overabundant strength of all, your storehouses are ever filled with plenty, and that the plenty

which fills them is distributed, with the freedom of the rain and the sunshine which falls alike on the just and the unjust, to whosoever hath need.

"Then shall your excellence and your beauty and your happiness grow brighter forever, until the vision of what you shall be is lost in light.

"We meet here today in the midst of beauty and grandeur to the production of which nature has lent her forces and man his art, the equal of which never was on earth before, and never would have been on earth if man in unison with nature had not lent his skill and his will, with the common strength of the nation, to its creation.

"Here where today a garden blooms and bears fruitage as no Eden ever before bloomed and fruited, where teeming thousands find plenty and delight, less than a decade ago nature spread a desert, where on the parched face of the earth no green thing could live, and now here in the desert blooms the fairest garden in all the earth.

"All may not live here, ought not. The world is wide and must be peopled. Have we here created anything that is good and pleasant? Go, then, into all the world and surpass in excellence the beginnings which here in the desert we have made. We have but pointed the way, have but entered upon it ourselves.

"Create your best ideals into material embodiments. The world is fair, its forces stand harnessed to serve your uses.

"If ye *will* truth and righteousness and excellence and beauty, ye may have what ye will. The world awaits you for its perfecting, and whosoever, with his head or his hand, shall contribute to its perfecting, he shall find joy in his work.

"There are other deserts to water, other barrens to plant, other waste places to clothe with verdure. Go ye out into the world and open the gates of Paradise to all its people.

"Perfect the means of travel; to him who dwells among the palms of the tropics a sojourn among the glaciers of Greenland or the eternal desolations of the Antarctic continent will be the fullness of life; and there is no part of this wonderfully varied planet to which all may not be given access at their pleasure.

"Let all mankind enjoy the earth and the fullness thereof."

Turning to the army, which at a signal now rose to its feet, the General continuing said: "Soldiers of the army of industry: It has been your good fortune to open to the world a new and brighter era.

"When your energies were turned from arms to implements, from war to peace, from tearing down to building up, your country knew not what to do with you, nor with itself. The earth and the fullness thereof was appropriated by a few. The energies of mankind were held in restraint. The wheels of industry, except as they could grind more wealth into the possession of those who already had all wealth, and further power into the hands of those who already dominated all governments, were forbidden to turn.

"Your maintenance in uselessness was destruction to you, and it was a burden too grievous to be borne to a people already overladen, yet there were neither homes nor occupations that could receive you.

"But you were led into the desert where no man lived, and there, turning your energies to useful industry, you have become self supporting; more than that, you have become rich; you who are of the active forces of industry have more leisure now than any millionaire twenty years ago could enjoy, and culture has opened to you her portals.

"In banishing poverty from among yourselves, you have banished it from the world. The truth which you have wrought into an object lesson has set free the human race.

"You each and all have your homes now, furnished in all convenience and embowered in all beauty. You who are yet within the years of public service all have your duties under a system that gives to your work the highest degree of efficiency; you will return to your homes and to your duties, and to the joys of your life, but no longer as an army.

"The citizen tenantry receives you all.

"As for myself and the general staff, we crave the privileges of private life, to which our age and services have long since entitled us.

"We desire homes in yon fair city at our feet, without the responsibilities of office, where we may move as equals among you.

"Our resignations have been accepted by the government.

"You go to your homes enfranchised with the duties and responsibilities of free citizens, and the gratitude and thanks of an emancipated world go with you.

"I now promulgate to you the order which is to be my last official act. The army is hereby disbanded."

So solemn, so earnest, so impressive, was this address that the mighty audience, who during the address to the army had instinctively risen to their feet, stood for a moment in silence, lost to themselves and their surroundings. Then rousing to consciousness they cheered until the canvas that covered the great amphitheater waved like the sea in a storm, and all the flags waved as if in sympathy.

Then the artillery fired another salvo, and while the orchestra played "My Country, 'tis of Thee," the great audience filed out.

It was now 4 p. m. The bulletin displayed on the rostrum when the exercises were finished, which was also posted here and there about the grove, announced, "Supper will be served

in the grove at 5:30 p. m. Fireworks will begin at 7:30. For best view, take seats in the auditorium."

The multitude had an hour and a half in which to wander as they pleased, while the music played, and the cannon thundered their noisy chorus in the interludes. When the audience had passed out, a screen was drawn across the front of the auditorium, behind which the scene shifters were busy. When, after the evening meal, this screen was withdrawn, a mighty change had come over the scene. The canopy which in the afternoon had shaded the vast auditorium was gone, while all around, where the bare walls of rock had been, now spread the bay of Naples with Vesuvius smoking in the distance, a panorama to which the rocky wall of the amphitheater lent itself admirably. The central part of the scene, however, where the speakers' stand had been, was fitted with shifting scenery, and the platform and the rocks above were arranged for the exhibition of fireworks.

And now as the shades of night closed in, rockets began to shoot, and the sky was filled with all manner of rainbow-colored meteors.

The landscape glowed lurid with red fire and flashed up into brilliancy with hidden lightning. Now amidst lightnings and volcanic fires and rushing floods the submergence of Atlantis is exhibited.

Then, on the scenery of the main landscape, Vesuvius begins to mutter and glow; Pompeii is alive again before our eyes, and again, amidst fire and rolling darkness and confusion, it is overwhelmed, while Vesuvius spouts fire, alternating with clouds of dust and ashes.

And now Rome is burned while Nero with his voluptuous company revels before our eyes.

Sweeping back through a cycle of time, Belshazzar's feast is enacted before us, and other brilliant scenes from history and mythology.

Now it is the great fire in Chicago seen from the lake, and finally in splendid brilliancy and gigantic proportions the allegorical figures of Peace and Plenty appear and bestow their blessings on all, and this most noteworthy of all celebrations of the fourth of July is ended.

CHAPTER XXV.

"And I saw no temple therein."—Rev. 21:22.

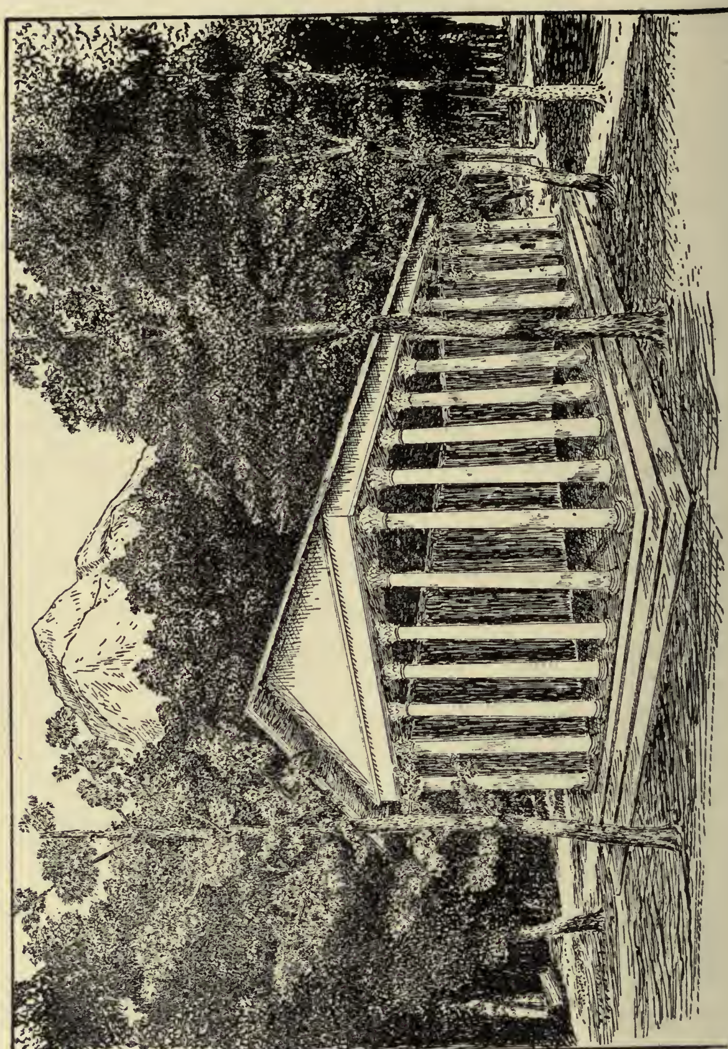
New Utopia is a rapidly growing city, and its location provides for a long continuance of rapid growth; it is full of halls and auditoriums of many kinds, but a visitor from any town that had grown under the ancient regime would notice the absence of churches. In fact there is not a church in New Utopia.

It was early in June of 1930, while wandering about the city enjoying its every varied beauty and its peace, we entered a shady grove in the midst of which stood a Greek-temple-like structure of white marble.

This contained no inner chamber, but its roof and upper structure were supported entirely on the columns that stand instead of its walls. There were curtains, however, that could be dropped between the columns to enclose the auditorium when and so far as might be desired. This was Herron Pavilion. There was a speaker's stand in it and chairs for the purpose of seating an audience. A bulletin on the front steps announced a lecture in this auditorium at 10 a. m., next Sunday, by Professor D. "On Religion versus Philosophy; some advanced thought from the nineteenth century, exemplified by Kidd's Social Evolution, and an essay by an obscure writer of the same epoch."

This was Saturday afternoon, and we decided to hear the professor in the morning, thinking that he would be likely to throw some light on the views prevailing in New Utopia.

Returning to the pavilion at the appointed time, we entered and took seats. The speaker's stand was at the south end, and behind this and on the eastern side the curtains were



dropped. The audience entered from the north which was open to the free air of heaven, as was the west side also. There was choral singing, and reading of elevating literature and poetry, a little preliminary ritual in fact, suitable to awaken high thoughts and sentiments, such that one might almost fancy himself in one of the liberal churches of the latter part of the nineteenth century.

The speaker began by saying: "The book with which we open our subject today is one that had considerable attention during the last decade of the nineteenth century among thinking people, or at least people who liked to be thought such, and the critics generally approved it.

"We will endeavor to glean from the book in such a manner as to convey a just and correct idea of the author's argument and position.

"As indicated by his title, Mr. Kidd poses as an evolutionist *par excellence*. His first postulate is this: 'Progress is the result of selection and rejection. If all individuals were allowed equally to propagate, a process of slow degeneration would ensue. The condition of progress is therefore one of continual strain or stress.' This he further emphasizes and particularizes elsewhere by declaring his conviction that: 'There can be no progress except by the accumulation of congenital variations above the average to the exclusion of those below.'

"We shall probably agree with Mr. Kidd that a condition of strain or stress resulting in the propagation of the superior and the weeding out of the inferior would greatly favor and accelerate progress, but the chief causes of the strain and stress on humanity to which Mr. Kidd refers have been war, and religious persecution, and we know, and it is hard to understand how the author could have failed to know, that through-

out the historic period war has weeded out from among mankind the physically best, and religious persecution has weeded out the intellectually and morally best, while the human race has been propagated mostly from the culls; and yet there has been progress. It would seem as if some factor has been at work that does not appear in Mr. Kidd's formula.

"But hear him further. Since a condition of strain or stress is not a pleasant one, and the strain and stress which has existed could have been avoided, Mr. Kidd says: 'There can be no rational sanction for the conditions of progress, because the future does not concern any existing people.' That the remote future does not and cannot concern the living is a statement that Mr. Kidd seems to think self evident, and he makes it an essential link in his chain of argument. Yet you who are now listening will strongly dissent from it, for the reason that you, from a rational sanction, have attained the concept and conviction of the continuity of life, a concept and conviction that Mr. Kidd, the religionist, evidently did not entertain nor believe possible, and would not have approved if he had believed it possible.

"But hear him continue. 'There seems to be no escape from the conclusion that the only social doctrines of today which have the assent of reason for the masses of mankind are those of socialism; and socialism, which would put an end to the stress and strain of life, would be utterly destructive to future progress.'

"One would like to go back 40 years and ask Mr. Kidd whether it might not be possible that the desire to realize an ideal better than present attainments might be a factor, at least, of a stress and strain from which progress might arise; and whether, considering the obvious fact that mankind, under the stress and strain of the fear of want, bred mostly from those

who knew least of, and cared least for, ideals, it might not promote instead of prevent progress to shift the stress and strain to a higher plane?

"But hear the conclusion which Mr. Kidd draws from the premises which we have cited. 'The interests of the individual and those of the social organism to which he belongs are not identical; on the contrary the central fact in progressive society is that the interests of the social organism and those of the individuals composing it are actually antagonistic and inherently irreconcilable.' This conclusion he makes a fundamental principle of all his following argument.

"No words of mine could make the reduction to an absurdity more complete or more obvious than his own. He holds that in order that society may fare well, the people that compose it must fare ill; and yet the orthodox thinkers, and the critics, of the nineties swallowed all that without a grimmace.

"Having discovered this wonderful fundamental principle, our author proceeds to use it in showing how human society, for its own good, from the beginning of history, has been held to a line of conduct opposed to reason and antagonistic to the welfare of the people.

"Hear him, he says: 'The central fact of human history is religion. Religion is not only independent of, but in direct conflict with the intellectual forces.' * * * 'The forces against which man is engaged throughout the historic struggle are none other than those enlisted against him by his own reason.' * * * 'Throughout all history we witness man driven by a profound instinct which finds expression in his religion recognizing a hostile force in his own reason.' * * * 'The central feature of human history is the struggle which man throughout the whole period of his social develop-

ment has carried on to effect the subordination of his own reason, its motive has been supplied by his religious beliefs.'

"Regardless, for the moment, whether such a line of conduct has promoted or retarded progress, whether it has been helpful or harmful to the human race, there is abundant ground for the assurance that regarding the character of religion as it has been a power among men, and the function it has performed, and the part which it has played in history, our author has in the sentences quoted, but told the simple truth.

"But we will defer our comments until he has developed his argument further.

" 'The function of these beliefs in evolution,' he says, 'is to provide a *superrational sanction* for conduct necessary to progress for which there can be no rational sanction.' Then he proceeds to define religion. 'The central element in all religious beliefs,' he says, 'must be the ultra rational sanction which they provide for social conduct.' * * * 'There never can be such a thing as a rational religion.' 'No form of belief is capable of functioning as a religion in the evolution of society which does not provide an ultra rational sanction for social conduct in the individual. A rational religion is a scientific impossibility, representing from the nature of the case an inherent contradiction of terms.' "And in this connection he recognizes philosophy and religion as antagonistic, it being the aim of philosophy to find a rational sanction for beliefs which religion rests on an ultra rational basis, in which so far as philosophy can succeed, such beliefs can no longer function as religion.

"In all this again we must admit that Mr. Kidd has truthfully characterized historical religion.

"Priestcraft, from the beginning of history, has denied the right to think. To accept rationally the substance of his dogma

has never been satisfactory to the religionist; it must be accepted unreasoningly on faith, on the *ipse dixit* of his 'thus saith the Lord.'

"When, for instance, his dogma of a future life was accepted thus it had sufficient vitality for the priest to add, on its strength, a deeper terror to the king of terrors, but not sufficient vitality to deliver the poor religionist from the fear of death: 'The fear o' hell's a hangman's whip, to haud the wretch in order.'

"The religionist usually thought, and habitually spoke, of the one who had passed into the higher life as lying in his grave. The priest did not in any rational sense believe in his own dogma, and for the one who would *prove* it true he reserved his deepest curse.

"Acceptance of the ultra, or super, rational sanction that our author insists on, is the submission of the soul to slavery, the poor religionist abdicating his right to think.

"So long as large bodies of people will accept this slavery the priest can hold dominion over them; when they reject it and insist on a *rational* sanction, religion has ceased to function and the occupation of the priest is gone. 'The truth shall set men free.'

"Our author finally sums up his conclusions in this first part of his book in this: 'That evolution is not primarily intellectual but religious, its most distinctive feature being that through the law of natural selection the race must grow ever more and more religious.'

"He could write this in the midst of a people among whom the religion that he had defined, with its ultra rational authority had long since lost its power; in the face of the fact that the most religious nations, using the word according to his own definition, Spain, Turkey, Persia were decadent, while every

people to whom religion was the chief concern of their lives were unprogressive and behind their age; in the face of the fact, obvious throughout history, that nothing else in human nature has been so utterly reactionary, so uniformly and intensely opposed to all progress, as the religion which he has defined, religion that has through all history arrayed mankind against their own reason; in the face of the fact that the emancipation of the minds of men from its bondage has proved everywhere the first condition necessary to progress.

"Mr. Kidd is a sophist to the priests' taste. He never hesitates to invert and reverse the most obvious facts, provided he can do so under the semblance of reasoning.

"Is this a subtle plan of his to discredit the antagonist against which he has arrayed himself, the human reason? If his were a fair sample of reasoning it could not well be denied that the effort was successful.

"Religion, such as he champions, with its ultra rational sanction, has burned the world's Brunos, imprisoned and tortured its Gallileos, opposed and interdicted with its ultra rational authority every newly discovered truth, every ray of divine light that has come to illuminate the human understanding; it has massacred or banished from whole nations every one who dared to think and be loyal to truth as it was given him to perceive it, and left in the land to propagate the race only the stupid who could not think, the coward who dared not, and the hypocrite who cared too little for truth to sacrifice anything for its sake.

"Let us rejoice that among us Mr. Kidd's principle of progress, religion with its ultra rational sanction and its irreconcilable antagonism to human reason and the welfare of the individual, is as extinct and as fossil as the pterodactyl.

"Before entering on the second part of our subject let us sing the Ode to Truth." (Page 27 of the Choral Songster.)

CHAPTER XXVI.

(A New Utopian Sunday Lecture, Continued.)

A Scientific Basis for Another Order of Being.

Rested and harmonized by the music and sentiment of this ode, the audience was again in a receptive mode for the second part of the lecture.

The Professor resumed: "The last quarter of the nineteenth century was marked by the final conflict in the world of thought, between materialism and spiritualism. Before the end of the century the battle was so far decided that the case for materialism was hopeless, nevertheless the hyper-conservative and reactionary types of mind failed to recognize that fact, and, as always, with their backs toward the light of the morning, persisted in their allegiance to outworn and dying error.

"In this class, of course, were found all who with Mr. Kidd held to religion with its *ultra rational sanction.* The battle was in the field of reason, and though a future life was a fundamental dogma of religion, nay for that very reason, to prove the continuity of life, and convince the thinking world of its truth on a rational basis, would be fatal to religion with its ultra rational principle.

"This, in fact, is precisely what has killed it. The life of religion was tied up in the absurd, the irrational, the self-contradictory; in its irrational dependence on arbitrary and miraculous power, instead of the principle of cause and effect, to produce the results desired or expected; in its dogmas, of the trinity, which was absurd, of the vicarious atonement, which was immoral and pernicious, and of the resurrection of

the material body, which was demonstrably false. But their very absurdity and unreason made these dogmas serviceable to a principle, the vitality of which depended on unreason, on the subordination of reason, on the blind acceptance of blind authority with its ultra rational sanction. The church was the last stronghold of materialism, and when materialism passed into the limbo of ancient errors the church vanished with it.

"But we are to review this morning some of the phases of the battle in which materialism was finally overthrown. For this purpose I have chosen an essay by an obscure writer of Mr. Kidd's epoch, from an obscure magazine that I found some time ago among a lot of old papers in the general library. The topic of the essay is, 'A Scientific Basis for Another Order of Being.'

"Our author says that: 'Materialism essentially consists in the teaching that all real existence consists of tridimensional matter, occupying space to the exclusion of other things, and that all phenomena are manifestations of its functions. Materialism is really based on the assumption that that which cannot be perceived has no real existence, not a postulate, notice, not stated as a fact upon which argument is based, but an assumption unconsciously taken. The scientific materialist, if this assumption were formulated as we have formulated it, would be compelled to deny its truth, nevertheless in denying this assumption he would knock the foundation from under every argument that materialism can rest on.

"Science never produced a materialist more decided than the late Professor W. K. Clifford, who died in the assurance that death was the end of all things with him, yet the teachings of Professor Clifford overthrow that foundation of materialism.

"Professor Clifford says: 'Radiant heat, which is physically identical with light, is capable of doing work. Any

change which possesses energy is a motion of matter. In that sense, and in that sense only, it is a matter of demonstration that light consists of the periodic motion of matter, of something which is between the luminous object and the eye; but that something is not matter in the ordinary sense of the word, it is not made up of such molecules as gases, liquids and solids are made of.'

" 'This statement is no guess, but proved fact. The sort of evidence we have, to show that light consists of waves transmitted through a medium, is the sort of evidence that footsteps in the snow make; it is not a theory which simply accounts for the facts, but a theory which can be reasoned back to from the facts without any other theory being possible.'

"So much from Professor Clifford. But here let us remark that the word matter was applied to the substance of which things are composed before the scientific mind had conceived of anything, or the possibility of anything, lying behind solids, liquids and gases, out of which solids, liquids and gases might be formed, and lacking the properties by which solids, liquids and gases are recognized; hence, in that stage of science the word matter very properly applied to the fundamental substance out of which all known things were formed. Matter in this, its proper and original sense, is always characterized by the qualities of weight, inertia and impenetrability, by which qualities it is made perceptible to our senses. When, from the advances of scientific knowledge, scientists began to conceive the reality of something imperceptible, lacking the qualities by which matter is recognized, lying behind matter as it had been known and defined, out of which they came to perceive that all perceptible matter was formed, most of them, like Professor Clifford, extended the meaning of the word matter backward to cover the new concept, and applied it both to the thing

created and to that out of which it was created. This, of course, led to much confusion of language and some confusion of thought, and we find Professor Clifford talking about matter which is not matter in the ordinary sense, and others talking about this imperceptible something as being the only *real* matter, thus denying to solids, liquids and gases their right to the word which had been applied to them and to nothing else from the beginning of scientific language. When the mind grasps a new concept lying outside of the domain of previous thought and language, it needs a new word. At least nothing but confusion can come out of using an old word in distinct and diverse meanings. When a word has come to mean everything it has ceased to mean anything.

"Confining the word matter, then, to its original and ordinary meaning, it is known to consist of molecules or atoms, which in gases are flying about freely, getting as far from each other as the pressure will permit. In liquids the molecules roll or slide freely upon, or at a nearly invariable distance from each other; and in solids each molecule has a fixed limit within which it moves—for all are moving—never exchanging places with others.

"Of the size of these molecules, Sir William Thomson, since dubbed Lord Kelvin, says: 'If you were to magnify a drop of water to the size of the earth, then the coarseness of the graining of it would be somewhere between that of cricket balls and small shot.'

"In regard to the physical constitution of these molecules, the name of this great scientist is associated with a theory that seems to be the only one that has any present scientific standing, namely, the vortex ring theory. Vortex rings are produced in air and gases by friction against the edges of the opening through which they escape with a puff. Everyone has seen

such rings formed of smoke discharged with a short puff from the lips of a smoker.

"The vortex ring theory of matter was due originally to a mathematical discussion by the German professor, Helmholtz, of the properties of vortex rings in a hypothetical fluid, which should be continuous and incapable of compression or friction. The result ascertained was that under these conditions a vortex ring must be permanent, impossible by any conceivable means to produce, but if it once existed, impossible to destroy; it could move freely, but could not be added to nor substracted from. These properties suggested to Sir William Thomson that such rings would form a basis for a new form of atomic theory in better accordance with known facts than any other which had been proposed. Accordingly, he made further researches on this hypothesis and found that the facts conformed to the theory as far as it was possible to test them.

"This theory is not a fixed certainty such as Professor Clifford describes the wave theory of light to be, but a working hypothesis thus far unimpeached, and probably true, enabling us to extend our researches from the known out into the unknown.

"It may be that *that* mode of integration of atoms out of a continuous substance is true, it may be that some other mode not yet conceived of is the form of their constitution, but that the ultimate atoms of matter as known to chemistry and physics are in some way formed of an imperceptible substance in which they remain immersed, is well nigh certain.

" 'This primitive fluid,' says Professor J. Clerk Maxwell, in the Encyclopedia Britanica, 'has no other known properties than inertia, invariable density, and perfect mobility.' Perfect continuity had, however, been previously stated of it; that is continuity in the sense of being without intervals or spacing

between its parts, without the intervening spaces that exist between the molecules of all forms of perceptible matter. 'According to Thomson,' continues Professor Maxwell, 'though the primitive fluid is the only true matter, yet that which we call matter is not the primitive fluid itself, but only a modification of that primitive fluid. *The primitive fluid itself entirely eludes our perceptions* when it is not endued with the mode of motion which converts portions of it into vortex rings and thus renders it molecular.'

"Professor Maxwell, however, continuing his discussion of this primitive fluid, assumes it to be subject to the laws of ordinary matter. Ignoring the perfect continuity, invariable density, and other qualities just recognized as pertaining to this primitive fluid that fills all space, he assumes it to consist of an exceedingly thin and tenuous gas. On this assumption, taking the velocity of the light wave and the ascertained amount of energy received on the earth from the sun in a given time for his data, he applies his formulæ to determine the co-efficient of rigidity and the density of the ether. In this way he reaches this conclusion: 'In interplanetary space, therefore, the ether is very dense as compared with the attenuated atmosphere, which, according to the law of expansion of gases, would exist in the same region, but the whole mass of the ether, within a sphere whose radius is that of the orbit of the most distant planet, is very small compared with that of the planets themselves.'

"This conclusion is obviously inconsistent with the facts which Thomson and Helmholtz have established, and which Professor Maxwell himself accepts in the outset of his paper. The fallacy to which this error is due is no less obvious.

"Density is measured by weight, but according to the theory of Thomson and Helmholtz, which is provisionally

adopted by Professor Maxwell, weight is a property acquired by virtue of the vortex motion which forms the atoms and converts the primitive fluid, the ether, into matter; hence regarding density as measured by weight the density of the ether should be zero. Yet since the ether is continuous, filling space between the atoms in all forms of gross matter, since the vortex motion, by virtue of which the atoms of gross matter exist, only applies to a part of the space which that matter considered as a mass occupies, and since the ether affected by that motion is not condensed or concentrated thereby, its density being invariable, it follows that considering density as opposed to porosity, as a measure of the nearness of the ultimate elements of a substance to each other, the density of the ether must be greater than that of any other substance. The quantity of ether in any given space must be invariable, no matter how much or how little of it is worked up into molecular matter, nor what form of matter it is worked up into, so that if quantity of substance is what Professor Maxwell means to compare, ether with matter, instead of the mass of ether within a sphere whose radius is that of the orbit of the most distant planet being very small as compared with the planets themselves, it is vastly greater than would be that of a sphere of solid platinum having the same radius.

"It is evident that the ether so borders on the material order of being that impulses moving in it with the velocity of light are capable of awakening a resistance in matter, but no motion of matter within the range of velocities known among material things is hindered by it in the slightest degree. Professor Clifford says: 'It has been maintained for a long time that there is a certain resisting medium which the planets have to move through, but the evidence on which this assertion was based has been entirely overturned by Professor Tait.'

"Professor Alexander Winchell, too, in *World Life*, collecting a great mass of evidence and reviewing the investigations of many men eminent in science regarding this matter, reaches the same conclusion.

"Professor John Fiske, too, says: 'The resistance offered by the ether to the planetary motions is too minute to be appreciable; it cannot be detected, is purely theoretical and is based on a fallacious assumption.' Of actions and impulses moving in and pertaining to this ether, however, Professor Clifford says: 'All we know of the ether shows that its actions are of a rapidity very much exceeding anything that we know of the motions of visible matter.'

"The most of what we know of the ether we have learned through the study of light, and conversely, it is mostly through the behavior of light in the presence of matter that Sir William Thomson and others have extended their researches so deeply into the ultimate constitution of matter. There are other properties or forces in nature, however, in regard to which less is known than we know of light, but which so far as they go speak wonderful things of the ether.

"Chief among these is gravitation. It has long been the custom to speak of gravitation as if it were an ultimate fact needing no explanation, but really of the wonders of the universe this is one of the chief. It has been spoken of so generally as if it were an action of one body directly on another, that we are apt to overlook the necessity that all action at a distance must be through a medium. Yet, Sir Isaac Newton, who first discovered and formulated the laws of gravitation, wrote: 'That gravity should be innate, inherent, and essential to matter, so that one body can act upon another at a distance through a vacuum, without the mediation of anything else by or through which their action and effort may be conveyed from

one to the other, is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it.' And in this respect the judgment of Sir Isaac Newton is yet the judgment of the scientific and philosophical world.

"No tenable theory of the mode of action of gravitation has yet been formulated. The facts known in regard to it, however, show the instantaneous transmission of its impulse through all distances at which its effects can be detected. This requires an absolutely perfect incompressibility of the medium through which its impulse is conveyed.

"Light requires eight minutes to reach the earth from the sun, its velocity being about 200,000 miles per second, hence the continuity and elasticity of the ether, though immensely greater than that of any form of ponderable matter, might, so far as the light wave alone shows, be a matter of degree, but when this medium transmits an impulse ninety-three millions, or billions of miles in no time at all, then degree cannot be admitted regarding its density, continuity, and other related qualities on which this transmission depends.

"Gravitation, light, radiant heat, and electro-magnetic phenomena, all require this space filling medium for their transmission. The qualities of this medium, which can be reasoned back to from the facts, differ somewhat, according to the class of phenomena we use as a basis for our reasoning.

"Whether all are transmitted directly by the 'primitive fluid' or by different modifications of it in the same sense as molecular matter, is a modification of it, but prevailing as universally as the ether itself, the science of the day is not able to tell us, but some of the facts ascertained suggest that the latter may be nearer the ultimate truth.

"The object of this discussion is, however, to enable us to obtain a better view, and at the same time a thoroughly scientific view, of the difference between the range of our powers of perception through our senses and the range of real existence.

"We have seen that before the closest scrutiny of physical science the solid rock, the hardest steel, the earth, our own bodies, and all the material universe, dissolve into a cloud of dancing whirl puffs of a substance which itself, though everywhere present, eludes every effort of ours to perceive it. They are a cloud less substantial when compared with that etherial mass than is the morning mist to our physical constitutions.

"This we know is a hard concept to accept while it is new to one, yet it is the outcome of the closest study into the nature of things that man has ever been able to make. And it will grow on the one who studies it. As we come to understand how these things can be, consistently with the existence of the solid seeming earth, and all that we are conscious of, we also come to perceive the probability of their truth.

"When we have taken in and digested this concept of the material universe it is no longer hard for us to understand the possibilities of the existence of other orders of being so different from the material that, to our cloudbank organizations with our foggy senses, they may be as imperceptible as the ether itself, and that they may nevertheless be organized in a manner far more perfect than is possible in the matter which we can perceive.

"Indeed, when we consider that every quality of the ether which we have been able to discover excels the corresponding quality of material substances in a degree immense beyond our power of comprehension, it seems quite possible that an order

of being may exist which may excel the material in variety, power, and perfection, in a like degree.

"Nor do we stand alone in this concept. Professor Fiske, in *The Unseen World,* quotes Professor Jevons as follows: 'All our ordinary notions must be laid aside in contemplating such an hypothesis, yet it is no more than the observed phenomena of light and heat force us to accept. We cannot deny even the strange suggestion of Dr. Young that there may be independent worlds, some possibly existing in different parts of space, but others perhaps pervading each other, unseen and unknown to each other, in the same space.' And this Dr. Young, it should be noted, is that professor to professors whose work is usually filtered down to ordinary thinkers only at second hand, but whose research and reasoning it was that finally fixed the wave theory of light in the realm of established and final truth.

"It is then with no lack, either of scientific grounds for the conclusion, or of high authority among scientific thinkers, that we claim a scientific place for another order of being imperceptible to our physical senses as an established scientific truth. Yet, having found a scientific place for such an order of being, and perceived the possibility of its existence as a factor of the great universe of being, to assume the existence of such an order of being proved thereby would be very far from being a scientific proceeding. The proof of the existence of such an order of being lies along other lines of research, in the investigation of the phenomena of life and intelligence, in which field those who are familiar with the evidence regard the existence of such another order of being as already proved in a manner as scientific as that by which the existence of the ether is demonstrated. And in regard to this, science, even material-

istic science, is now self-estopped from denying it *a priori* as it has been wont to do.*

"This review and philosophical essay illustrate as well as anything within its compass the battle between religion and philosophy, or between materialism and spiritualism, in which materialism, and with it religion in its historic sense, was finally overthrown.

"Some may wonder why it was that the vanquished sophist rather than the victorious philosopher was famous, known and read and talked of by the world. ''Twas ever thus! He is regarded knave or fool or zealot plotting crime, who for the advancement of his kind is wiser than his time.'

"It is also true that the last effective power of the churches was their ability to advertise into the world's notice, and secure a large reading for, any book which pleased them, or by a conspiracy of silence to condemn to obscurity many of such as they desired should remain unread. Kidd's Social Evolution was a novel defense of their principle of unreason, and the priesthood of his epoch were not acute enough to see that it was more destructive to those it defended than it could possibly be to those it attacked."

This ended the lecture. The sweet zephyrs of the Pacific, bearing with them the odors of many flowers, rarified and cooled as they had floated up the mountain side, had fanned the brows of the audience while they listened all through this rather heavy and lengthy lecture.

None but a trained audience could have listened to it without weariness, but every New Utopian audience is a trained one.

*For an essay in this field of phychological research, see "The Missing Sense," by the present author.

As they passed out into the lovely vistas and beautiful homes of this fair city, they felt that the inner truths of a bygone epoch had been opened to their understanding, and their minds had been fed. And the midday melody from the great organs in every tower floated over and permeated every copse and cranney in all this great and beautiful city as they departed.

CHAPTER XXVII.

Eighteen years have passed since the memorable summer when the army was disbanded and General Goodwill delivered his noble valedictory at the great celebration of the Fourth of July in the mountains above New Utopia.

During these years whatever remained of the ancient regime has passed away. The Co-operative Commonwealth is perfected. Every town in all the land has its public industries now, producing all needed supplies, its public stores, where all things needed are kept in store and from which they are distributed to those who desire them, its public services, by which all needful services are rendered with the greatest efficiency and economy possible; and invention has been very fertile in this field during these years.

There is no longer any town, nor any home, in all the land, that is shabby or unsightly, nor any human being in poverty nor in danger of poverty.

There are no lonely farm houses now. The fields everywhere are cultivated under power, on the system first introduced on the irrigated lands about Fort Goodwill; and the people everywhere, in order to have the benefits of association, the public services, the leisure, the society, the lectures and the schools, have moved into the towns.

Forests and groves are everywhere cared for under public charge. The whole land is like a landscape garden. Electric railways, deriving their power from liquid air power stations, thread the country in all directions, while paved parkways, along which the swift motor carriages course, thread the

groves, and meander along the river banks, and stretch across the fields.

The horse is everywhere limited to the uses that were found for him at Fort Goodwill thirty odd years ago. Except for sports and exercises he would be as rare as the elephant in the land.

There were some towns whose leading citizens thought they would be conservative and use the power, which wealth and property gave them, to retain there the ancient order. But in order to enjoy the new, the people of these towns left them, and their wealthy citizens were compelled to relinquish their purpose and accept the new order also, or their towns would quickly have ceased to exist.

The rich are no longer distinguishable. The ancient money is received yet in the public stores, and when received it is destroyed, excepting that an assortment of it is kept in the museums attached to every school. Since the public industries and public stores were established, the only money issued has been the time check for services and the certificate of deposit for goods received in the stores.

But though the rich man's money will buy goods, more than ever of them, there are no longer any people that he can hire. He can get no services but the public services, and there are none but can have these as well as he. Hence the millions of the millionaire are as useless and unmeaning as they would have been to Robinson Crusoe or in the Kingdom of Heaven, where it is easier for a camel to pass through the eye of a needle than for a rich man to enter. The rich man has entered here and no man has robbed him, but his riches have lost their power and he is no richer than the rest.

We have found our place and played our part in the east during the time of these transformations, but the desire has

come upon us again to visit New Utopia, and what were the arid lands, and we are now on the journey.

We are traveling by the southern route; where we are now the desert used to burn with its fiercest heat and no green thing could live, but we are flitting along through orange groves, and past plantations of bananas, and gardens of pineapples. The fragrant guavas grow on the clustered shrubbery at the foot of yonder cliff, and the pomegranate, more valued for its splendid flowers, deep cups like tulips, of orange blended into scarlet and crimson, than for its fruit, for many better kinds have been developed since the days when the pomegranate was a favorite. Limes, lemons and figs, too, and almost every kind of tropical and subtropical fruit, find their place in these gardens.

Now the sparkling waters of Lake Diaz shine through the glossy green of the orange groves and among the feathery plumes of the cocoanut palms; and now the eye sweeps broadly over its surface with its hundreds of white sailed yachts.

These waters are now swarming with fish, and the shallows are thick bedded with the choicest oysters. The grey pelicans promenade along the shores in regiments and brigades, picking up any stray mollusk that may have drifted to the beach, while they vary this occupation with flights over the water in order to carry on their more active fisheries.

Bathing beaches and picnic groves here and there along the margin invite the passerby to pause and enjoy the pleasures of the scene. The mountains to the westward, with their shady sides toward us, as of old, rise dark against the sky. The sunlit faces of the nearer cliffs and rocks on our right glow red and brown and slate colored and grey among the groves that cluster in their valleys and gorges.

The great girdling canal that carries the waters of the glacier around to irrigate the plain that used to be the Mohave desert, is yonder above and beyond those crags, and it spares on its way water enough to keep all these gardens flourishing as we see them.

In the farther distance the mountains are clothed in the same rich lilacs and purples as of old, in varying tints which must delight the eye forever.

And now far up on our right and before us we catch glimpses of the great glacier of the San Bernardino, shimmering white through the leaves as we flit along through the orange groves. And now, as we run out into the alfalfa meadows and forage fields that furnish food for the cows in the dairy of New Utopia, it spreads in all its dazzling brilliancy before our eyes.

Suddenly our neighbor across the aisle, who has been intently watching the landscape on the left of our course, utters an exclamation. "In the name of all that's enormous! What's that?" Turning in the direction which he indicates we see swelling out from behind the nearer peak what seems to be a great spherical bubble, itself of mountain size, resting on a building of noble architecture as a base. "That," remarks the conductor, "is a school house."

As we draw nearer, the eye quickly recognizes on the surface of this enormous sphere the familiar outlines of the continents of the terrestrial globe. But now our train draws near the southeastern foot of the great flue, and the trellised towers and the glassy luster of its side are seen towering like a mountain wall high on our right.

Our road curves toward the left, and now we cross the canyon of the San Jacinto river and are coursing along by the groves and lawns that clothe the slopes that border the plateau

on which New Utopia is built, where here and there can be seen through openings among the trees, glimpses of white colonnades and stately towers in the city above, while the mountain background towers darkly behind and the great sphere that arrested our attention some twenty miles back, now somewhat behind us, swells grandly over all.

And now our train pauses under the arches that rest on the long colonnades of the New Utopia station. We step out, and taking seats in an automobile omnibus are rapidly whirled along the curving avenues among the lawns and the groves, the noble palaces and the dainty cottages, and all the beauties of New Utopia.

Just as we reach our hotel, one of the palatial apartment blocks that have been described, near the center of the city, the evening melody floats over and through it all, and the parting sunlight tips the great glacier of the San Bernardino, yonder in the northeast, with the whitest of fire. We are warmly welcomed, and as we are conducted to the apartments that are to be our home, on our veteran's right without expense, so long as we wish to remain in New Utopia, the peace and beauty of the surroundings pervades us and fills us with a most serene satisfaction.

Since our former acquaintance with these scenes New Utopia has spread more widely over its plateau, but the greatest change apparent to the eye comes from eighteen years of added growth to the trees. This change is a most satisfactory one; it corrects the one defect that art without the help of time could not remedy, and gives to the scene the only charm it lacked.

In the course of the city's growth many notable buildings have been added, and the artistic effort to perfect them all in beauty and to make every part of the city perfect in the har-

mony of each part with its surroundings, and with the whole, has been faithfully persisted in, but so far as any description could go, it is like adding more trees to a forest or new flowers to a garden.

One building that has been erected and completed since our former acquaintance here, is the great hall at the city center. This from its position and purpose was necessarily made the noblest building in the city, with every architectural feature wrought to the utmost perfection, and it is the largest building of all, except the great one on the hill, on which rests yonder all dominating sphere.

CHAPTER XXVIII.

That great building on the hill yonder is worthy of our special attention. It is the outcome of one of the suggestions dropped in the box for the people's forum a few years ago; an idea that so pleased the people that, great as was the work involved, it went through the mill without a check, was finally adopted, and there it stands in its greatness, unique in all the earth.

As a suitable site for this building the New Utopians leveled down the top of a knob of a mountain that formed the northernmost summit of the San Jacinto group adjacent to New Utopia, rising from just above the 3,000 feet contour line that forms the mountain border of the city, and, on the southward or city side of the canyon of the San Jacinto river. The original elevation of this knob was a little less than 1,000 feet above its base at the city border, and, by cutting it down 350 feet a plane of rock was formed on which to found the building, the shortest diameter of which was a little more than half a mile, and its height above the city border 640 feet.

The material removed from the top of the knob, deposited above a properly constructed dam face of stone, served to fill the canyon of the San Jacinto river in a very substantial manner and so formed a much larger reservoir than any of those originally constructed in the mountains, which constitutes a very valuable addition to the city's available supply of water.

This building is fitted to the dome rather than the dome to the building, and therefore the dome claims our first attention. This dome is a terrestrial globe, on the scale as exact as science and art can make it of one in twenty thousand, treating the earth as a true sphere on the equatorial radius.

This building is, of course, framed of steel, every part being copper plated and finished as were the towers in the great flue. The sphere is the simplest, and at the same time the strongest figure possible. It is also an accepted fact that of all simple figures it is the most beautiful.

A segment, subtended by 70 degrees of the great circle only, is submerged in the supporting base of this globe, which is cut out and the margin rests on a great ring of steel in the flat roof of the supporting building. This ring rests on a circle of 36 massive supports of steel, which enter into the framework of the building. Each of these supports consists of two massively built columns, inclined toward each other and meeting at the top, where they unite in a saddle of steel on which the basal ring of the great dome rests. These supports are placed radially at intervals of 10 degrees of the circle about the center of the building, their columns forming a double circle on each of its two main floors. The diameter of the circle above, at the center of support in the steel saddles on which the great dome rests, is 875 feet. The basal building is hexagonal, in two stories, of which the second story stands back within the border of the first, a distance of 75 feet. The front of each face of the hexagon in each story is a colonnade of Ionic columns, with all the related parts proportioned according to the rules of classic architecture.

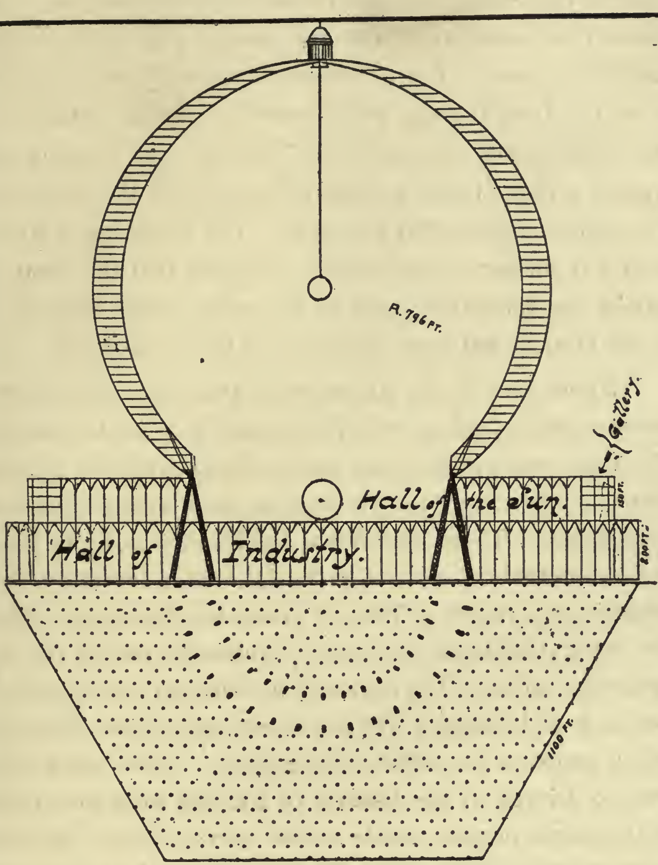
The portals are at the angles, each of them surmounted by a figure gracefully sculptured in collossal proportions. The lower and outer story is 200 feet high, and each of its six faces, measured along the line of the columns, is 1,100 feet in length. Hence, of course, the diameter of the building from corner to corner through the center is 2,200 feet.

The top of this lower story, about the borders of the building, is an open promenade 75 feet wide, upon which the floor

of the second story opens. This ceiling of the first story and floor of the second is supported on steel columns placed hexagonally, in accordance with the general plan of the building, and 50 feet apart. Each of these columns throws out branches at 50 feet from the top, which meet the similar branches from the neighboring columns at the ceiling, thus forming gothic trussed arches of steel to support the floor of the second story. The upper story is 150 feet high. The structure of its frame within is similar to that below, excepting that the great space within the supporting ring of the great dome, 850 feet wide in the clear, is left open to the top of the great dome.

Under each of the six angles of this upper story there are elevator shafts leading from the ground floor to the roof above. The frame work of the dome itself consists primarily of 36 meridional segments, placed 10 degrees apart over the main supports below. These meridional frames consist of an external and an internal rim of steel, each of the same curvature, namely circular, on a radius of 796 feet minus the thickness of the surface work; that being the twenty thousandth part of the earth's equatorial radius. The center of the internal rim is placed 100 feet back and dropped five feet below that of the external one which supports the surface of the globe. This causes the two rims to diverge to the distance of 100 feet from each other in their central portion, while at the vertex, where the several segments meet, they approach quite near together; the portions of the circles which approach and would interfere with each other below, are cut away in the opening at the base.

The space between these rims is braced and framed with steel in such a manner as not only to give the strength required to support the dome, but also to support a floor winding about the inside of the dome spirally, and rising 25 feet in each circle.



PLAN & SECTION OF FRAMEWORK.

NEW UTOPIA SCHOOLHOUSE.

These meridional frames are braced together on the inner surface by plates like those of a ship, and on the outer surface with steel sashwork on the same curvature as the rims. The supports of the spiral floor serve, too, greatly to strengthen the structure, that floor being of tile supported on steel. The whole is surmounted by an observatory 75 feet in diameter and 150 feet high, consisting of a dome supported on columns.

The external surface of this great globe is a map of the world in glazed tiling on the scale of one to twenty thousand of nature, which is 3.188 inches to the mile. This permits a very great degree of detail, and it is desired that every tile shall be a model of the part of the earth's surface which it represents, as perfect in form and coloring as it is possible to make it.

Every nation has been invited to contribute to the surface of this globe the map of its own territory. This invitation many of the most advanced nations have accepted in whole or in part. Where these tiles are not furnished they are made here with such degree of detail as is possible. Whenever any locality desiring to be honored with fine work on this model of the earth, furnishes a more perfect piece of workmanship than that already in place, the original is removed and the finer work substituted. When any locality prepares to furnish a tile or tiles for this purpose, very precise information in regard to where the lines of division between the tiles fall, is, of course, given to those preparing to furnish them, as also a fac-simile of the shades of coloring used on the bordering parts of the map. Each tile corresponds to 10 minutes of longitude and 10 of latitude.

These tiles are grooved along their edges, and fasten to the framework of the globe by a system of sliding bars and wedges worked from the inside, a thin layer of cement being also placed on their adjoining edges. There is a system of steel stanchions,

also, rising through this tile map, to support a steel cable track on which observation cars run outside the globe. The structural meridians of steel in the frame of this globe have no relation but an accidental one to the earth meridians in the map. These are so placed that the geographical axis of the globe is with great exactness parallel to the axis of the earth in space.

The observatory on the top rests over the Mediterranean Sea, its center being located in latitude 33 degrees and 40 minutes north, and longitude 18 degrees east. The missing part below has its center at the antipodes, 33 degrees and 40 minutes south latitude, and longitude 162 west. Sweeping a circle about this center on a terrestrial globe with a radius of 35 degrees, anyone can see at a glance what is cut out. The missing portion includes New Zealand, Samoa, the Fejee Islands and a few others. Australia comes very near the edge of the map, without, however, being mutilated. As a compensation for this omission a map of New Zealand, on the same scale and curvature and mode of workmanship as the general surface of the great globe, is exhibited in the hall beneath.

Water is represented on this globe by tiles of wavy translucent glass. The polar regions and glacier surfaces are modeled in white porcelain. Early summer in the northern hemisphere is chosen as the season to guide the coloring.

Passing into this building through the grand portal at either of its six angles, we first enter the great hexagonal hall on the ground floor, more than one-third of a mile in diameter. Its central parts are brilliantly lighted day and night by electric lights; the great windows, 150 feet high, that fill the walls, render artificial light superfluous by day for a long distance from the margin.

Conspicuous among the forest of slender columns that support the ceiling, toward the center of the hall, is the double circle of massive trussed columns of steel, all plated and burnished with copper in every part, and each radial pair in the circle leaning gently toward each other, which are all that can be seen in this hall of the main supports of the great dome.

In this hall there is an immense and comprehensive museum of nature and art, equivalent to one of the greater world's fairs of the last half of the nineteenth century, but vastly more satisfactory to the mind because here everything is arranged in such order as to show its evolution from primordial beginnings in nature, and from primitive simplicity, or in some cases complexity, in art. The commercialism and desire to advertise, which furnished the prime motive of the world's fairs, being absent here, repetitions are avoided and order and system is made possible, as under the commercial system it was not possible.

This is a comprehensive use for this hall, and one that requires a large space, yet the greater part of the hall is unoccupied; it doesn't trouble the New Utopians, however, that space remains yet unused, to stimulate the genius of the future for a long time yet to come in finding objects of interest to place here. To have such a room in waiting to receive such objects is in itself a good thing.

Taking an elevator, or mounting either of the six grand stairways if we chose, and ascending to the second floor, we are in the hall of the sun. The height of this hall varies. The central part within the supporting circle of the great dome, a space 850 feet wide, has the top of that dome for its ceiling, making the height of this part of the hall about 1,600 feet; from the edge of this opening to 100 feet from the margin of the hall the flat roof of the building is its ceiling, supported on steel

columns similar to those in the great hall below, and the height of this portion of the hall is 150 feet. All around the margin of this hall, to the width of 100 feet, the upper hundred feet of its height is cut out for a gallery, leaving the height of the hall beneath the gallery only 50 feet. This gallery is not, however, open to the general hall, but is entirely walled off as a separate chamber.

The circle of main supports for the great dome, which in the hall of industry below appears as a double circle of great columns in pairs, placed on radial lines from the center of the hall and inclining toward each other, in this hall of the sun is seen as a similar double circle of massive columns meeting each other in the rim of the great dome. This circle creates a marked distinction to the eye between that part of the hall lying without the circle, which is studded with columns like the hall of industry below, and the part within where the space is open upward into immensity.

Why this is called the hall of the sun is evident at a glance, for in its center, lifted just clear of a low rim of moulding that surrounds it at a little distance on the floor, is a great, brilliant golden sphere. This is 142 feet in diameter, it is gilded with crystalized gold, but one wonders by what art it is made to shine with such exceeding brilliancy, until we discover that it is in the focus of a double circle of powerful searchlights, one circle of such, 36 in number, being contained in the cornice about the opening of the great dome, and the other within the rim of the circle that surrounds this sphere on the floor. These lights each being placed in the focus of a deep parabolic reflector, the axis of which is directed toward the center of the golden sphere, and which reflectors are themselves set deep in the mouldings of the cornice of the upper and lower circles, can not be seen unless one gets between them and the model

sun, which is not a convenient place to get. This makes a very pretty method of illuminating this great hall; and the model sun being directly under the center of the great dome above, very effectively assists in illuminating its vault also.

Ranged about this central sun are other globes mounted on orbits of encircling steel rods, supported on slender davits rising from the floor. These globes represent the planets, each in its proper relative position with regard to the sun and the other planets at any given time. These orbits are so constructed that their ellipticity shall be true to nature, and the direction of each planet's axis, with reference to the plane of its orbit, is true to nature, also. The motions of each planet in its orbit and on its axis, and the satellites with their motions and relative positions, are copied true to nature also, their motions being governed by fine clockwork adapted to the purpose.

The scale of magnitudes chosen for the dimensions of these models of the planets is 500 miles to the inch, and the same scale applies to the model of the sun, making each planet of its proper relative size. The scale of distances is a convenient sliding scale; nothing less than space itself could accommodate such an orrery as this if the same scale were observed in distances as for the dimensions of the planets, and then the original of nature would be infinitely superior to the model for purposes of observation.

The earth on this scale is a globe about 16 inches in diameter. Mounted on its orbit in the plane of the sun's center, it is 74 feet above the floor, and a moving platform is provided from which to observe it. Its axis is in true relation to the plane of its orbit, that is inclined 23½ degrees, and the clockwork with which it is ingeniously connected through its mounting causes it to move exactly as the earth itself moves. It is mounted in a thin transparent hemispherical shell darkened to

represent the night and fixed on the side opposite the sun, in which the globe turns on its axis while the shell remains unmoved. The map can be seen through this shell as if it were shaded with India ink, but at the edges it clears up into pure transparency, representing the twilight. Fixed with this shell are slender metallic meridians 15 degrees apart, marking the hours of the day, and these hour meridians are continued across the darkened shell, marking the hours of the night also. By this device the hour of the day or night at any moment at any part of the earth can be seen at a glance. The month and day of the year also are marked on the orbit, and attached to the mechanism, at a little distance above, is a circle to a point on which the pole of the earth is directed and which marks the movement of the earth's axis in the precession of the equinoxes; along this circle are graduations marking the intervals of 10, 100 and 1,000 years, the numbers corresponding with the era of our calendar. Thus, on this globe the hour of the day for any place, the day of the month, the month of the year, and the year of the era, can all be read at any moment.

The moon, at a distance of eight feet from the earth, the scale of distances here being one-fifth the scale of magnitudes, moves true to nature in all its motions, its phases shown by a mechanism similar to that representing day and night on the earth; all these are moved with beautiful precision by an apparatus invented and perfected for that purpose.

The models of the outer planets are each built on the same scale of 500 miles to the inch, and made to show the characteristic features of the planets represented; each moves in its orbit and on its axis in its true time; no attempt, however, is made to model the asteroids in this orrery. Jupiter is a shining sphere about thirteen feet in diameter. Saturn, about eight feet in diameter, with its rings and satellites, makes a very striking

object in the hall. Uranus and Neptune also are very noticeable objects, the latter running on its orbit very near to the circle of supporting columns under the margin of the great dome.

Returning to the central sun, a movable step is placed for us under it on the south side, and, the attendant touching a spring, an invisible door opens and we step inside. Then we mount a spiral metallic stairway to the center of the sphere, where we reach a platform about ten feet in diameter and surrounded by a railing. The door by which we entered closed immediately behind us, and now we find ourselves in a hollow sphere very faintly illuminated by one incandescent light just over the platform, with a shade above and about it. As our eyes become accustomed to the gloom, we perceive that we are in the center of a celestial globe. The door by which we entered is at the south pole of the heavens; the shell of the sphere is pierced to correspond with every visible fixed star, and minute points of electric light moved in their proper course along fine wires on the inside of the globe, mark the visible planets each in its place. Each visible star is made a very little brighter here than its apparent magnitude in the sky, in order to give inferior eyes here the power which good ones enjoy in the open sky. The shell of this great globe, which seen from the outside is all alike, is moved about its axis in star time, so that the apparent position of the stars at any time corresponds with their position if observed in the heavens at that time; this motion is effected through friction rollers moved by clockwork in the supports on which the globe rests. The platform on which the observer stands, together with the stairway by which we ascend, rests on fine casters and remains in its proper position by its own weight. The inside of this sphere is painted a deep blue, and the milky way and the visible nebulæ are painted in their place with phosphorescent paint in such a man-

ner that their faint luminosity is scarcely distinguishable from that with which they appear on a star lit night. Standing here one seems to be in very truth in the midst of the open heavens on such a night, with the advantage that no part of the heavens is concealed by the earth.

Returning to the hall of the sun and looking up into the great dome above, we perceive that its vault is illuminated by another orb which is suspended exactly in its center, though as seen from the floor it appears close to the ceiling. This represents nothing but a chandelier, though in looking at it one is apt to think of the moon. The eye not realizing its distance, it would be impossible to judge its size, but its diameter, we are told, is sixty-five feet. This globe is covered with frosted aluminum and it is lighted by a triple corona of powerful electric lights, each placed in the focus of a parabolic reflector with its axis directed toward the center of the sphere, so that to the observer the lights themselves are invisible. The light reflected from this orb illuminates the interior of the great vault in a manner very satisfactory to the eye. The inner surface of the great dome itself is lined with frosted aluminum similar to that on the central orb, and as the eye wanders over its expanse we perceive that it is set with some two hundred little balconies, to each of which a door opens from the gallery between the shells of the dome, and over each is a line of incandescent lights that twinkle like stars as one looks up at them.

Proposed designs for the decoration of the interior of this dome are on exhibition in the offices of the department of construction in the city hall, where anyone who feels so moved may submit another. These designs are competitors for the favor and criticism of the people, but it is not intended to close the competition and reach a decision in this matter until 1960, thirteen years hence.

CHAPTER XXIX.

(A New Utopian School House Continued—The Gallery of Evolution.)

All about the margin of the hall of the sun, as has been specified, the height of the ceiling is reduced to fifty feet. In each of the six angles is a double elevator shaft reaching from the ground floor to the roof. All around the six sides of the hall, between these elevators at the angles, with one exception, there is an unbroken succession of windows or rather, except when the weather calls for closing them, open doors, reaching from the floor to the ceiling and opening upon the bordering promenade on the roof of the hall of industry. In the middle of the western face, however, this succession of open windows is interrupted by a broad stairway ascending to the gallery above. Mounting this stairway, which in its lower half rises toward the western wall, but turns on a broad landing and opens into the gallery above toward the north, we enter the gallery of evolution.

This is a long gallery, a hundred feet wide, nearly thirty-three feet high, extending three times round the hall of the sun, making its length, measured around its outer border, a little more than three miles. This gallery is designed, so far as art can compass the end, to put the visitor in the presence, in appearance, of every stage in the development of the world, from primordial nothingness to the historic epoch.

It contains a panorama; the panorama of eternity.

Here where we enter is nothing but the blue of empty

space on walls, and ceiling and floor; or, perhaps, we might fancy a slight cloudiness pervades them, but nothing more. Passing on a little, the cloudiness is unmistakable, and here art has done its uttermost to depict the first beginnings of a world and its satellite, indefinite in outline, misty in their nebulous envelope.

Then it is clearer; we see depicted a glowing fiery surface below, a glowing satellite above, the sun, broad-faced and lurid, across the ceiling, blending into cloud in its outline and less brilliant than the fiery moon. A little farther on, the scene is darkened as if the earth were swathed in dense clouds of smoke; neither moon nor sun is seen; the earth's surface glows a dull red and metallic oxyds are precipitated as a thick dust upon it, floating here and there on a surface of molten metal. Again, the scene is cooler, but the vapor yet dense; a rain of salt covers the planet like a heavy snow.

We go on; the darkness deepens. It rains. It pours. Lightning here and there breaks the gloom, and here and there a hot rock repels the falling water in clouds of steam.

Again, it is lighter, but yet dark with clouds. Ocean now covers the earth, but it is an ocean of hot water, loaded with minerals in which no creature can live. These scenes, we are made to understand, cover immeasurable aeons of time.

Again, it is clearer; the dull sun peeps broad-faced through the clouds overhead, the dull moon appears half-way down in the margin. Some of the minerals have crystalized and separated from the water, forming thick beds of granite in the bottom of the ocean. Here and there swelling bubbles of land break the surface of the sea, but their substance is unstable and the waters are agitated in fury so that as fast as earth is uplifted the swelling land is torn down and

again spread on the bottom of the sea. We pass on, and now the sea is more quiet, its waters are transparent. A brighter sun, not so broad-faced, shines above; yonder moon in quadrature looks familiar; we have turned the first angle in the gallery here and are in the silurian age of geology; we see down in the shallow waters where thick-bedded mollusks cluster; there beds of crinoids wave their tentacle fringes, while trilobites creep and crawl about among them. Yonder is the great orthoceras; coral beds cover the ocean's bottom; here are a hundred kinds of marine life thick peopling the waters, but not a vertebrate among them all. A few low-lying, rocky banks rise above the water and mosses grow on them in varying forms, passing from the sea weeds in the water to the mosses on the margin, and these varying in form and habit of growth until some of them are fern-like in their luxuriance; and mollusks, some with shells and some without, crawl out of the water to feed on these mosses, and some learn to live there. Among these primitive and non-specialized forms variation is easy, and in this scenery a hundred gaps between form and form are filled with intermediate forms that in later stages of evolution have perished altogether. Many long ages are here depicted, but we pass on.

Now a few fishes appear in the water; a little farther they have grown many and great and strange of form. We are now in the devonian age. The land growths also have become more varied and of higher type.

But we pass by life-sized pictures and modeled scenery, stretching far, in which the slow evolution of many types by sea and land appears.

Now from the seaweeds and the mosses a vegetation great and strange has developed. We enter a forest of tree ferns and great fluted rushes as high as our gallery will permit

them and then cut off in the middle for want of room, erect, leaning, sprawling recumbent, forty, fifty, or sixty feet long and a foot and a half thick among a dense tangle of marsh vegetation beneath. The sprawling branches of the lepidodendron interlace themselves over our heads, and great tangled roots form a thick mat on the marshy ground.

Of the animal types there remain the fish and the mollusks, and the corals as before, though many forms have passed away. Among the fish, lizard-like types are developing, and, as in the silurian age, it was with the water mollusks, so now it is with the fishes, some of the lizard-like variations of these are taking to the marshy borders for their prey and learning to live there. Other types have developed, too; here and there is a gigantic frog, and insects, on which the frog has come to prey, are flitting in the air and resting on the ferns and rushes over the marshes.

This scenery is modeled in aluminum and colored with exquisite art. Where the modeler's art ends the painter's begins, and on walls and ceiling so nicely is this painting adjusted to the modeled scenery between the walls that the eye hardly distinguishes where the one ends and the other begins, and the gallery appears as boundless as the wilderness it represents.

Everything that has been revealed to scientific research regarding the conditions and variations of life may be found here, each in its place. The variations of each form may be noticed as we pass along, so that the process of evolution as one species varies and gives rise to others, is unfolded to the eye. Not at a glance, however, as one passes through, can all this be seen, any more than without careful attention and study we can see all there is to be seen in nature around us,

it is the cataclysms and the consummation of epochs that one notices most on merely passing through. And here such a change is upon us.

A flood breaks over the scene; the vegetation is swept together in great masses, filling valleys and deeply covering the marshes where some of the heaped-up debris has grown. Sand and mud is spread over the heaped-up vegetation by the rushing waters; and now the monstrous vegetation starts anew above the mud and grows into a tangle more dense than before. It is the coal period through which we are passing.

But here we have completed one circuit of the building and are come again to a broad flight of steps which are just over the stairway by which we entered the gallery. The scenery continues, however, up the stairs and on.

And now the earth begins to have a more habitable appearance. The land seems more firm, the waters more open and clear.

But what is that which seems to be rushing through the water yonder, half crocodile and half fish, and as long as a whale? That is the ichthyosaurus. And, see yonder, those snaky necks and snaky heads rising high above the water, and the tortoise-like bodies that carry them. The creatures seem to be fishing yonder on the shallows; they are the plesiosaurus. And here, as we enter this grove, is a flight of strange creatures in the air; they are of various sizes, but are neither birds nor bats, winged lizards rather; these are pterodactyls. And yonder, among the rushes by the water's edge, are the dinosaurus and the iguanodon, and through these jungles and about these waters wander strange creatures a-plenty, both great and small, but lizard-like in form and features nearly all of them. Some are stalking about on their

hind legs like birds, with their heads lifted high, but dragging a reptile tail behind them.

A little farther on we come to some lizards whose necks and legs have grown bird-like, or birds that are lizard-like, which? Their scales seem to have grown long and split into coarse feathers; their reptilian beaks have teeth; their long-jointed tails have grown quills, one on each side of each joint, and by the aid of quilled wings they can fly. These are the Archeopterix macrouri, and there are variations on the type.

Yonder in the grove is the great glyptodon with his tortoise-like body and head, his crocodile-like tail, and his enormous strength and weight, tearing down trees for his food.

A little farther on, here is the megatherium and other beasts of various sizes, of mammillian type, but reptilian features. A new type is coming on the stage, but there are no breaks in the chain of evolution, and in this gallery nearly all gaps are filled between fish and reptile, between reptile and bird on the one hand and between reptile and mammal on the other. One of these queer links has survived through the ages to our own time, in the ornithorynchus or duck-billed platypus of Australia.

These trees and bushes and these water plants grow ever more familiar and natural in their appearance as we pass on. The water yonder is full of fish of types common in our own time; the strange forms common in the devonian age are gone, but the corals and the mollusks have changed but little since away back yonder in the silurian age, when their ancestors first peopled the seas.

But here, again, we come to the second flight of stairs and again the scenery continues without interruption as we pass up.

Some of the trees that appear about us now, we could call by name, but the beasts that dwell in these forests and roam these plains and haunt these marshes are many, and many of them are great and fierce. Here are great tapirs and rhinoceroses, and yonder is the little eohippus, the five-toed ancestor of the horse. And with these come ape-like forms upon the scene that skip among the trees and live on nuts and fruit, and down by the sea shore they dig clams to vary their diet, and they hide themselves among the rocks, and in the tree tops, and flee from the great beasts which are too strong for them.

Farther on the great beasts have grown yet more numerous and more fierce, but many of them we could now recognize and call by name. Here is the saber-toothed tiger, and the great cave bear, and hyenas and lions, all far too large for their kinds as known to the modern world. And here is the mastodon, too, herds of them, in the thickets and about the marshes.

But here our attention is called to a scene that marks the branching off of another kind. It is near the edge of a lava flow from a volcano and some dry wood has been burned by fire spreading from the lava. A group of the larger ape-like creatures, full of curiosity, are prowling around the ashes when one of their number burns himself on some smouldering fire. Like all other animals, these have feared fire, but, angry and smarting from the burn, this ape snatches the brand that has burned him and throws it violently away. It lights on other dry vegetation and a new fire is kindled and the apes stand shivering by and watch while it burns.

Another scene; one of the young apes returns and stirs the ashes with a stick and smoke rises again. He puts more fuel upon it and flames burst forth; two or three other young

anthropoids join him, and as the fire burns down they add more fuel. They seem to like to play with fire as many a human child in after ages has done. But the older apes are conservatives, and, with many a fierce claw and cuff and bite, they express their displeasure at what the youngsters have done.

A group of these youngsters have, however, learned, with the help of fire, to start a fire, and, associating with each other, they take to building fires at the doors of their dens, and thus they have a great advantage over the others who fear the fire. They take to using fire in their conflicts with the other animals, both in attack and defense, and now the fire-using ape, instead of shrinking in terror away from all stronger beasts, is master of them all and they flee from him.

The conservative tribes are at the mercy of the weather, and they are over-powered by the fierce beasts of the forest; they dwindle out and perish, or, where the climate most favors them, they leave a posterity of more agile and smaller monkeys skipping among the trees. But the fire-using apes advance toward the north and multiply, and make war on the great beasts and conquer them. They even attack the great mammoth and kill him. Their brain power, giving some of them greater readiness in devising expedients to win victory, or acquire food, or to find or construct shelter and warm it, becomes a greater and greater factor in their welfare. The progressive multiply, the conservative perish, and the descendants of the apes that took to using fire are men.

Not yet, however, men such as now people the earth; their arms are long, they stoop forward, and often fall on all fours; they skip among the branches of the trees as their ancestors did before them; their bodies are clad with hair and they wear no other garment. Physically they are an-

thropoidal apes. Such was miocene and early pliocene man, "the missing link," but a new variant had been introduced into the world, namely, mind, and armed with a new weapon, namely, fire.

We watch this newly endowed creature now as we pass along the gallery. Gradually, as he becomes accustomed to the mastery over all animated nature which the use of fire gives him, he forsakes his tree-climbing habits and takes more to the rocks. He has become the cave man.

He learns to dig pitfalls in which to capture the larger beasts on which he preys, and he takes to sharpening slender poles in the fire and using them as lances in his wars against the beasts, and against his own kind, too. He takes to binding splinters of stone in his club to make his weapon more deadly, and to using sharp splinters of stone as implements for other purposes. Naturally, too, he learns to break stones and to shape such splinters roughly to suit the purpose for which he desires to use them.

And this is all for many ages.

Then some great cataclysm comes on the earth; the great hairy mammoths of Northern Asia flee in herds and perish together, and their bodies are covered with snow and embedded in ice before the flesh has time to decay from their bones, and some of them have remained thus frozen solid even to our own time. The same great disturbance drives the denizens of other parts of the earth to perish together in multitudes likewise. Great continents of the earth are strangely plunged beneath the water and as strangely emerge again, and this repeatedly. Sand, gravel, clay, earth, and rocks, are torn from their ancient beds and cast in tumultuous heaps on the plains and into the waters, and with these cataclysms came the ice, but certainly the ice did not cause the cataclysms,

and as certainly their onset was not gradual with the slow progress of secular changes. Not yet have we read the causes of these convulsions aright, but the earth was well nigh depopulated. Both man and beast perished, leaving but a remnant of survivors.

The earth-shudder recurs again and again, while the ice lies deep on the land. And the snow and ice last long; it retreats and again advances; and the beasts and the men, descendants of the remnant that escaped the cataclysms in the outset, follow its retreat and retreat before its advances; their tribes are mercilessly weeded out in the struggle; they who are strong in body and fertile in expedient live; they who are slow to change their ways, who adhere strongly to the customs and conditions to which they were born, perish; not a conservative survives the sifting, and in the bitter conflict with unfriendly nature through a thousand generations *homo sapiens* is developed.

But there are regions here portrayed that have suffered less from these convulsions. Yonder, where the ocean interposed a barrier against the ice, a remnant who have fled by water have found a friendly retreat and developed something of a civilization. They find metallic copper in thick flakes as nature deposited it, and, hammering and chiseling these into such shapes as they wish, they improve their tools and their weapons.

But now convulsions of nature overwhelm this retreat in turn, and amidst earthquake and storm and volcanic fires this favored land sinks beneath the sea. This is Atlantis; but men bearing with them the arts of Atlantis have from time to time wandered elsewhere, to the shores of Britain and continental Europe, where the conflict with nature, and the natural selection among men that it carried with it, had lasted much longer

and gone much farther than it had when the Atlanteans colonized their island. They had gone to Egypt, also, and colonized there, where the primitive people of the ancient type vanished before them. For in Africa, removed beyond the reach and knowledge of those who were struggling with the ice of the glacial epoch and the convulsions of nature that preceded and accompanied it, great regions were scarcely at all affected by these vicissitudes. There the primeval pithecoid man followed the natural course of evolution, and the conservative type who adhered to the ways of their fathers survived and dominated the race; to this is due the unprogressive negro type.

But we pass on, and as we go we watch the progress of the tribes that sprang from those whose ancestors had been weeded and sifted in the conflict with inhospitable nature amid the ice and the floods, and all the cataclysms and vicissitudes of thirty thousand years.

The unprogressive types have been exterminated from among them, and the ape characteristics are eliminated; it is a higher type of man that repeoples the plains of Europe and Northern Asia as the ice finally retreats; but the new tribes jostle and contend with each other, and send out swarms of emigrants to war against those who have occupied the earth before them. We are now among a shepherd race, from which springs swarm after swarm of such emigrants. Their home, we understand, is Central Asia, and these are the Aryans.

But here we again come to the stairs, and the third and final spire of the gallery of evolution ends here. The stairs this time ascend not toward the north as before, but turn toward the right hand directly eastward. Ascending them, we find ourselves in a sort of pavilion on the roof of the hall of the sun which opens on three sides directly upon the flat top of the building, but on the fourth, the eastward side, it

opens into a corridor leading directly into the base of the great dome.

Each of the six elevators at the angles also terminate in a similar pavilion to this with a similar corridor leading into the great dome.

These, however, lead to the landings of elevators that run up the dome to the observatory on the vertex, while this leads to a short stairway, at the head of which the gallery of historv begins.

CHAPTER XXX.

(A New Utopian School House Concluded.)

THE GALLERY OF HISTORY; AN EXCURSION ROUND THE EARTH.

The door at the end of the corridor by which we enter the great dome opens in the Pacific Ocean a thousand miles, more or less, west of Chile.

Turning to the left and mounting a short flight of stairs, we find ourselves at the beginning of another gallery which here is about fifty feet in width, though in the course of two turns about the dome its width expands to a hundred feet. The height of this gallery is twenty-five feet minus the thickness of floor and ceiling. It stretches interminably before us bending continually toward the right in its circuit of the globe. The floor rises as we advance, sufficiently to bring it in the course of each circuit above the ceiling of the preceding circle, but this rise is imperceptible. There are about sixty laps in this spiral between its beginning at the base of the dome and its termination under the vertex, and the whole length of the gallery is more than fifty miles. During the day the greater part of this gallery is well lighted through the glass tiling that represents the water of the earth on the outside map, nevertheless artificial light is everywhere provided sufficient to render the gallery entirely independent of the daylight.

The same combination of models and painting which we have seen in the hall of evolution is continued in this gallery, though here the modeling is mostly devoted to the setting of natural scenery appropriate to the foreground in the time and locality portrayed, while the historic movement is set forth

in paintings accompanied by the printed narrative so far as this is needed; and here every portion of the gallery is devoted to a definite epoch, each century and decade being blazoned on the border under the edge of the ceiling. Each nation and region of the earth is given parallel space, Africa and the southern hemisphere being assigned the inner curvature on the right as we advance.

Everywhere, for every epoch the scenery is true to the portion of the earth depicted at the time represented; it forms the setting for the historic scenes and permits the portrayal of the every-day life, the habitations, the arts, conditions, customs, implements, and mode of life of every people in every stage of their evolution.

At the beginning of this gallery we find ourselves again in the presence of the Aryan shepherds, to whom we were introduced at the end of the gallery of evolution, but in parallel lines is scenery portraying the condition of every other people and part of the earth, concerning which at this epoch anything is known.

Here we witness the migrations and wars of the Aryan tribes against their less energetic neighbors, the overrunning of the plains of Hindostan, the congealation of this type in a conservatism of its own in Thibet, the colonization of Greece and Rome, the progress of the Atlantean civilization in Egypt, and of the Chaldean in Persia and Arminea, while the lake dwellers yet linger in Europe. We witness the building of the Egyptian pyramids, and the rise and fall of all the great peoples of antiquity. Scattered along not far from the inner curvature of the gallery are a few pieces giving us hints of conditions in the unknown western continent through all these ages.

Every event and every condition of life that history has recorded or archeological research has revealed is depicted

here, and whenever some new delver in the dust of antiquity reveals some episode that history had lost and some new artist portrays it a place awaits it here. And every piece that is admitted here is accepted provisionally, to remain until some other artist produces a work that meets its purpose better; then, the new work having its truthfulness and its artistic merit tried in the court of history and being judged worthy to succeed the old, the substitution is made.

That fidelity to truth under this plan causes much of this gallery to partake of the qualities of a chamber of horrors is no fault of the New Utopians, but it is well that history, even the horrors of history, should not be forgotten as the world passes into a better era.

But to attempt, on this occasion, to see the history of the world, or to tell it here, would be absurd. There are nearly forty miles of it in this gallery, while the upper turns of the spiral, which belong to the future, are devoted to the ideal.

In the commercial age, a few years ago, before the construction of such a building, or such a gallery as this could have been attempted, the question must have been asked: will it pay? All this work must have been measured in money, and after it was done it must have paid perpetual tribute to those who had advanced the funds, or the credit; and the cost, so measured, would have been so enormous, and when completed, the use of the work under the restrictions necessary in order to raise the required revenues would have been so limited that the answer must have been quick and conclusive: no it will not pay, and therefore, under the commercial system such a building could never have been built.

But did that system pay? When the majority were in want, and almost all were in the fear and danger of want; when they who were in the greatest need could not lift a hand to

satisfy their need except with the permission and for the profit of others who had plenty, it was a sorry reward they got for all their hustling.

Now there is no need to ask that question; now there is no want, nor danger of it.

For a long time, as we have seen, the whole population have been students with ample leisure to develop their talents. Under the conditions of life prevailing in New Utopia not to be a student is to demean one's self and lose the respect of one's neighbors. Naturally, among these people there are many artists who are also historians, and many historians who are also artists. To furnish this great gallery of history, or the gallery of evolution beneath, is with them a labor of love, and to have a piece here is an honor to be coveted. If any one thinks that they who have built this great building and furnished it have taken no pleasure in their work he knows not human nature; and for the rational satisfaction which any one may enjoy in having at his door such an epitome as this of all that man has ever been or known or done, who would be so dull and so indolent as to refuse to contribute his effort?

The people of New Utopia had but to compute the number of days of labor required with the machinery and methods in use, in order to construct this building, and then to tax themselves extra hours enough to cover it in a reasonable time, and the building was constructed. They have worked an extra hour each day for six years, the retired men up to the age of sixty at their urgent request sharing the tax, and this building is the result, completed, paid for and free. The art work is all amateur work done at the artists' pleasure, and it is free. O, yes! It pays.

One may take either of these elevators from the base of the dome or from any point above, mentioning the century he

wishes to visit, and be landed among the people and the scenes he wishes to see.

We will take the elevator here to the observatory on the top of the dome. Entering the car which is suspended in its running frame, and therefore adjusts itself by gravity to the level position without regard to the angle of the track along which it runs, we run out and up and up and in again, turning gradually to the horizontal direction as we follow the curvature of the globe. The car halts at an hexagonal parlor under the vertex, which is ten feet high by 100 feet in diameter.

In the center of this room there are two stairways, one going up and one going down. The one going down terminates on a platform, surrounded by a railing, from which one can look over into the immensity of the great dome and the hall of the sun beneath. Looked at from this point that central orb which illuminates the great dome seems to rest on the sun in the hall below, and is scarcely distinguishable from it. It is here that the lights must be attended that illuminate that central orb. The man who takes care of them moves a lever on this platform and the rings which bear the lights come sliding up the rod by which the central orb is suspended until they are ranged about this platform where the lights which they bear are swung in and attended to, then the lever being moved again, down they go to their places.

We will now mount the stairs leading to the outside. We emerge in the center of an open pavilion, about which is a circle of twelve stately columns and a light railing, with a gate in each interval between the columns. Outside this railing in all directions swells the shining expanse of the great globe. Mounted by the side of each of the twelve columns is a fine terrestrial telescope with a six-inch object-glass, through which one may see all the distant landscape at pleasure.

In the center of this pavilion, rising above the opening of the stairway by which we have entered, is a winding stairway leading to the base of the dome above. Mounting this to the chamber within the frieze that rests on the capitals of the columns we find ourselves in a small chamber, lighted by one incandescent light, from which twelve doors open toward the outside. Passing through either of these doors we find ourselves in a chamber which, except for a luminous picture thrown on a screen which it contains, is dark. This picture, however, is a perfect reproduction of the scene which may be viewed through the telescope beneath. Each of these chambers is a camera obscura of the most perfect construction. They communicate with each other through doors in the intervening walls in front of the screens, and the twelve of them are so many eyes on the retina of which all the world about is always pictured and may if desired be photographed at any moment with microscopic nicety.

Above the landing in the center of this camera circle is a trap door manhole opening into the interior of the dome of this observatory in which is stepped the foot of the great flagstaff, as large as the mainmast of a ship when the masts of ships were the largest, which rises from the apex of the dome and from which flies the flag when it is desired to display a flag on this building; it is run up through a wicket beside the flagstaff in the crown of the dome. Higher than this we cannot go. We return to the pavilion of the observatory; its diameter is seventy-five feet. It is supported on continuations of the steel framework of the great dome, at a height above its map surface just sufficient to permit a man to walk erect on that surface under the floor of the observatory. The part of this map surface covered by the observatory, however, represents nothing but water, its center being located in latitude 33 degrees 40 minutes north,

which is the same as the latitude of this building, and in longitude 18 degrees east from Greenwich. Sicily, southern Italy, Greece, and a part of northern Africa, are near enough for our inspection from the pavilion, and one cannot fail to admire, and can scarcely tire of examining, the niceties of the modeling and coloring of the rugged surface of Sicily with its great volcano of Etna, and of southern Italy with Vesuvius, and Naples and the mountainous coast of its famous bay, and the islands lying near. The excavations of ancient Pompeii are visible, and the southern Apennines all modeled and colored with exquisite precision, and Greece, great for the part which it has played in the world's progress, even what we can see from this pavilion is worth coming far to see.

But we will take an observation car and make an excursion round the world, in twenty minutes if we wish, though we shall find it profitable to take more time than that.

These observation cars run on steel wire cables mounted on stanchions bolted in the framework of the dome and rising through the tile that constitutes the map. These cables, and the stanchions that support them are too slender to be easily seen from the ground below, but they are strong enough to support many times the weight of the car with as many passengers as it can carry. The cables forming the tracks lie in parallel pairs and the cars are suspended from a motor apparatus that is hooked over them. Thus suspended the car hangs level whether above the globe, on its side or under its overhanging swell.

One gets a better sense of the relative magnitude of the regions of the earth by viewing the whole in a model like this, and it is a rare pleasure to inspect its surface modeled so perfectly that every mountain and ravine is there in its proper form and proportions. Even this building finds its place on this map

in correct proportions in a model nearly an inch and a half high.

It is as if we had been magnified into giants towering to the height of twenty miles, the earth remaining as it is, excepting that gravity, instead of holding us on its surface, is for the greater part of the way trying to pull us off.

Seen from the ground anywhere about the foot of the hill on which this building stands this globe looks exactly as the earth itself must look if seen from a distance of three or four times its own diameter.

But our car is on its way. Its course is guided by switches to any part of the globe we may wish to visit, and we run down its northwestern side to the shores of the polar sea; thence following the line of the Rocky mountains and the Andes from the Arctic ocean to Cape Horn; crossing the Atlantic now to near the Cape of Good Hope we skirt the eastern border of Africa to near the equator; now crossing the Indian ocean we pass over Hindostan, Burmah and China; sweeping around north to the pole, we return by the way of the North Cape, the Scandinavian peninsula, the British islands, and thence by way of France and Italy to our rendezvous in the Mediterranean sea. We have had a great excursion, truly.

CHAPTER XXXI.

It is one o'clock p. m. We are again on the rail, traveling over the desert road that was built during that first hurry season to bring the army down from Fort Goodwill to winter in the milder climate of southern California.

Immediately after leaving the New Utopia station we pass through the great flue. The altitude where the railway crosses it is only 1,800 feet, nevertheless a perceptible chill and dampness creeps into the car during the ten minutes of our transit. Emerging on the west side of the flue we are at once among the orange orchards and gardens of Redlands and San Bernardino. Through these, with a momentary stop at each of these towns, we continue for two hours; then bending around the western end of the San Bernardino range we push out into the plain that was the great Mohave desert. Here with the great glacier shining high and white on our right and behind us, for more than a hundred miles we run through wheat fields and meadows that are now watered from that glacier.

There are no fields more fertile than these and none on which the crop is more sure, all the conditions on which it depends being absolutely under control. All this region is, of course, cultivated under the power system, the power immediately used being electricity derived from liquid air engines instead of from water power as originally used for that purpose. Indeed, water power sufficient for this purpose could not have been had here, but when the heat of the earth will move our machinery it is even cheaper than water power, besides being always on hand when wanted. The labor that would have been necessary to farm this Mohave desert without the liquid air

power, even if steam power had been used in its stead, would have been many times greater than it is.

As the sun is sinking toward the western horizon we draw near the mountains again, and soon we come to the town of Vitre.

This is a pleasant little town consisting of four Fort Goodwill blocks, that is just a mile square; its terrace overlooking the salt lake of southern California on the east and its mountain spur behind it on the west, have already been described, but it is all embowered in trees now and its gardens and its parks overspread the rugged valley toward the northwest, in which the water supply of the town is gathered.

The glass factory is here yet. Excepting its own services, that is the only industry of the town; it produces most of the plate glass used west of the Mississippi, besides a hundred other forms of glassware, but it has never had another order like that for glass to enclose the great flue, nor is it likely to have another such, hence the glass works are not nearly so large as they were when first established.

Night closes in on us here, and we retire to our sleepers.

We pass in the night two extensive wheat districts; the first, inNevada, which we enter only about forty miles north of Vitre, covers the ground formerly known as the Amargosa and Ralston deserts.

The second is in southwestern Utah in the region shown on the old maps as Escalante valley. Neither of these districts were irrigable to such a degree as to fit them for agriculture until the increased precipitation occurred after the completion of the great flue and the glaciation of the San Bernardino heights. Both of these districts are cultivated by forces from Mount Ceres, camping temporarily in their vicinity; they are

known as wheat districts, but, of course, wheat is alternated with other crops in these districts as elsewhere.

In this great scale farming, by the commonwealth, there are many advantages besides the application of power machinery which were entirely out of the reach of the old style individual farmer, one of which is the ability successfully to contend with insect pests. An example of this occurred in the season when the southern Nevada tract was first made ready for cultivation. The Hessian fly had been detected in the Fort Goodwill wheat fields the previous fall, and again in the spring the little pest was found plying his vocation with his usual industry. They were not numerous enough as yet to damage the crop much, but what their presence meant was understood well enough, and in recognition of the presence of the Hessian fly not an acre of wheat was sown that year nor the year following in all the Fort Goodwill district, and every other crop in which the pest could live was plowed under or remained unsown while the ground was devoted to cultivated crops. Meanwhile the full crop of wheat was grown in the new territory.

When after two years of this treatment 250 square miles of wheat were again sown in the Fort Goodwill district the fields were as free from the pest as when they were first reclaimed from the desert.

If the old time farmer could have plowed up his pest-ridden fields and put two or three hundred miles between them and the nearest crop that could harbor the pest, he might have exterminated the Hessian fly and the wheat midge and all other insect pests that brought his labors to naught, but with his neighbor's wheat field just over the fence from his own, no matter how faithfully he might endeavor to cut off the ene-

mies' supplies, the foe was always ready for the first new crop that he might sow.

When we renew our observations in the morning we are coursing swiftly through the valleys and passes of the Wahsatch mountains. But how the region has changed from what it was when the road was built thirty-three years ago. Then it was savage in its desolation, in every open valley or long slope one might have watched the course of a jack rabbit as he skipped away, until he vanished in the far distance, but now everywhere there is a healthy young forest growth. The rocky summits of the peaks, and here and there a vertical cliff or a jutting crag, lift their rugged forms grandly above the foliage, but all the slopes are covered with trees and all the valleys are filled with the forest. We notice the foresters' supply stations as we pass, but all this region is without permanent inhabitants. Soon we enter the Utah central, or Mount Ceres, irrigated district, and note its long aqueducts of stone stretching away in the distance; and its power sheds, and its grain fields and its meadows, and its great orchards of peaches and pears, and its vineyards, for here it is that all the fruits of the middle latitudes thrive best. The daily trains, with cars cooled by liquid air, deliver even the most perishable of fruits at the catacombs of New Utopia or the cold storage vaults of Fort Goodwill, or in any other town, in perfect condition.

After sixty miles of this region our train sweeps out on a magnificent bridge of steel, crossing the Green River canyon, then after following up the canyon for a short distance on its eastern side and bending round a curve toward the right it stops in the station of Mount Ceres.

From the railway station of Mount Ceres, or from the dairy and stock district of the town, which is located a little further on between the railway track and the foot of the mesa,

we ascend to the city by an inclined plane railway. The declivity bordering the mesa is covered with trees and vines and shrubbery with here and there a grassy terrace, all of which are watered according to their need, from above.

The plan of the city is essentially like that of Fort Goodwill, and it is built on a shoulder of the mesa, which constitutes a terrace bordered above by a second escarpment rising to the general level of the plateau, about a hundred feet higher.

We halt here especially to view the works by which water is supplied to the city and to the great mesa that was chosen for its site, making our home while we stay in one of the fine hotels about half a mile back from the head of the incline by which we entered the city.

We have chosen for our stopping place one of the most lofty edifices in Mount Ceres in order that we may have the benefit of an unobstructed view of the landscape lying about the city.

We mention this object to the custodian of the building, and ascending the elevator, we are conducted to a room occupying a sort of turret or tower that forms a picturesque feature in the architecture of the hotel.

It is on the sixth floor, and opens on one side, on a roof bower, and on the other three sides by balcony windows directly to the distant landscape. It has the usual gas fireplace and every furnishing that could promote comfort.

From our windows the geometrical plan of the adjacent blocks is spread out before us, and among the trees that are grouped in the garden plots and border the roadways the pretty houses are peeping through, and the groves and shrubbery and lawns in the angle squares, enlivened with bright beds of flowers, and the domes and towers and colonnades of the public buildings rising here and there above the foliage,

make a picture very pleasant to the eye. But it is the background of the picture, the distant landscape, that is noteworthy and unique.

Standing on the balcony of one of our north windows we see spread before us, and stretching away to the eastward until it blends with the pale blue mountains of Colorado a hundred miles away, the eastern division of the Mount Ceres agricultural district. Its nearer part is not too distant to permit us to see the lines of power sheds that separate it into fields half a mile wide; a number of the stone aqueducts are also visible in a long succession of arches stretching across the country as the Romans built aqueducts of old. Behind all this rises the dark wall of the Roan Cliff mountains with their undulating sky line, terminating directly north of us in a deep notch through which the Green River canyon comes down from the north. From this gap across the plain, toward us and passing to the left, lies the dark chasm of that canyon now bordered with forests, and beyond this chasm toward the west lies the western division of the agricultural district, more broken to the eye by ravine, mountain and mesa than the eastern division, but clothed in verdure everywhere. On the western side of the gap through which the canyon creeps, the mountain wall rises steep to an altitude two thousand feet greater than that attained by the Roan Cliff mountains on the eastern side of the gap; it is under that steep declivity that the tunneled canal comes down, carrying the waters of the Green river from the Fort Goodwill district.

Through that gap, in the dim azure distance, another mountain peak is seen. That is Emmons peak, the loftiest of the Uintahs, which lies beyond Fort Goodwill about a hundred and forty miles away.


The Mount Ceres
Agricultural Dist.
Contour Map.
9000ft.
8000 ft.
7000ft.
6000
Western Div.
6000 ft.
7000ft.
6000
Eastern Div. Irrigating Canal. 5000ft.
Grand River Canyon
5000ft.
6000ft.
Green River
Canal
5000
Mount
Ceres
Canyon
Reservoir
7000 ft.
6000ft.
Collecting Canals
5000ft.
6000 ft.
Canal.
7000ft.
Collecting
5000
Ridge
7000ft.

Taking our position now at an eastern window the expanse of the eastern corn fields, now at our left, stretches away as before. Directly before us and toward the right, the green park on the mesa rises above the buildings and groves of the city, while a massive swell of the Rocky mountains sixty miles away in Colorado forms a dark purple background to the whole. To the right of this a nearer mountain mass looms up, capped by four lofty peaks which stand ranged like saw teeth against the sky from the west to the southwest; the northernmost of these is Mount Waas, reaching the height of 12,500 feet, the second is Mount Tomasak, 12,270 feet high; the third is Mount Peale, 12,100 feet high; the fourth Mount Tukuhnikivatz, 10,815 feet. These peaks are the cresting on the roof on which the water supply of Mount Ceres is gathered; the swell from which they rise abuts close on the Grand River canyon; the distance of the peaks from Mount Ceres varies from forty to fifty miles; they look as if one might walk to them before breakfast, but anyone who should try it would find that he had more than a day's work before him, even if the canyon did not interpose its impassable barrier.

To the southward of this group of great peaks at about double the distance is another group with four more peaks ranged along in order; these are the Abajo (lower) mountains. Still farther west and curving up toward the north, at about the same distance as the Abajo mountains, another range of four great peaks notch the horizon. These lie west of the great Colorado canyon, and northward from these, behind the forest-clad swells of the nearer uplands, the peaks of the Wahsatch range break the sky line with a dim undulating band of azure.

Mount Ceres, as its name implies, is an agricultural city to a greater extent than is Fort Goodwill. It is from here that the forces go out to cultivate and harvest the wheat and the

corn fields on the great irrigated plains from California to Colorado. In the dairy and live stock lines the two cities, Fort Goodwill and Mount Ceres, are about equal, these industries being essentially parts of the public service tributary to the city to which they belong, but Fort Goodwill, from its more northern latitude, its elevation, its accessibility, and its water power, is better adapted to iron works and general manufactures, while Mount Ceres is more central to the irrigated districts of the arid lands as a whole, and was therefore chosen as the center of the agricultural operations by which the eight millions of people who now inhabit the arid lands are fed.

The next morning after our arrival in Mount Ceres we take an automobile and set out to see the works by which the city and plateau are watered. Here, of course, except hydrants in their proper places of all sizes for all uses, there is nothing of the waterworks to be seen.

Our road leads toward the southeast. Like all completed highways in this new commonwealth, it is a well paved avenue with its adjacent grounds artistically kept in order. Our carriage bowls along through the fair city and up the grade to the upper plateau; thence through three miles of landscape garden, followed by orchard and vineyard and forest and meadow in pleasing alternation for twelve miles, before there is anything to be seen pertaining to the waterworks excepting that we know that every green thing in sight is dependent on those hidden waterworks for its life.

But now we are in the center of the mesa, and here the land reaches the highest level attained anywhere on its face. On this swell about two hundred feet above the level of the city a reservoir has been built a mile square, retaining the water enclosed to the depth of 45 feet.

About the border of this reservoir is a terraced embankment, which is all we see of it as we approach at its northwest corner. Here, while the main highway divides, one branch continuing southward parallel to the foot of the embankment and another turning eastward, likewise parallel to the embankment, there is a grade leading up to the summit, up which we guide our vehicle and continue our course along the boulevard that we find on the top of the terrace. Here we have the lake-like expanse of the water on our left and the young forest beneath us on our right, while the way is bordered with the choicest flowers on either hand.

For a mile and a half we follow this boulevard to the middle of the southern side of the reservoir, at which point a combined stone aqueduct and bridge abuts on our embankment leading in from the south. Our boulevard, curving in from each side, continues on the same level over this bridge; but here we may pause and see the waterway beneath the pavement of the highway. This we find consists not of an open canal like those of the irrigating aqueducts, nor yet of a closed one, but of two iron water mains lying side by side, each seven feet in diameter.

Across the mesa from the south as far as the eye can reach this aqueduct and bridge extends, built on graceful stone arches, as of old the Romans built their aqueducts, but with more pains taken in its architectural embellishments than the Romans ever took with any aqueduct of theirs. We continue our journey over this bridge fifteen miles in a straight line and on one continuous level. As we pass over the gently undulating surface of the mesa our height above the ground varies, now it is nearly a hundred feet. Yonder on the swell perhaps not more than twenty; at two places, where the level of the bridge approaches that of the ground, there are cross roads connecting with the bridge.

The country here consists of alternating forest and grassland, forest bordering the mesa also, and clothing its escarpment wherever trees can find a foothold. These grasslands are mostly used for sheep pasturage.

The gentle breeze that fans us as we ride along the bridge is invigorating; the landscape spreads before us and about us in magnificence, and that the enjoyment of our ride may be prolonged we so moderate the speed of our vehicle that an hour is consumed in traversing this fifteen-mile straight reach of our bridge, then we reach a point where it bends about thirty degrees to the eastward and changes from stone to steel. We are now approaching the edge of the mesa and as we do so the land sinks away from our level until we are from one hundred and fifty to two hundred feet above its surface. Now we reach that edge and our bridge assumes the cantilever type, while, as we run out over the canyon, the land below us sinks away to dizzy depths. We follow our aerial highway across the canyon at a height, one would think, to make an eagle's head reel, but with practice one gets used to viewing distance in the vertical direction as well as in the horizontal.

The supporting towers of this bridge that rise from the bottom of the canyon reach the height of two thousand feet; on either side there are others that have their bases at higher levels, but even these tower to heights greater than was attained by any bridge previously built.

There are eight miles of this steel bridge from the angle on the mesa where it begins, to where we touch ground again on the other side of the canyon. Where we reach terra firma on the left bank of the canyon there is a tributary ravine on our left coming down from the plateau between the upper and lower mountain groups. The acqueduct along the course of this ravine assumes the type of a covered canal with different

levels, the water in which is controlled by automatic valve gates, being finally admitted to the great conduit pipes on the bridge under the pressure of fifty feet head. Our road rises two or three hundred feet in the five miles of its course parallel to this ravine, then we come to one of the great stone dams so characteristic of the hydraulic operations of the army during its career of usefulness. This dam lies across the valley from which the ravine we have been following originates. Its height is 250 feet, and it is three-quarters of a mile long. Above, the valley spreads out to a width of from three to five miles and to the distance of ten miles back it now forms a lake.

Before these works were built this valley and all the lands adjacent were as dry as Sahara; even the sage brush and the cactus were abnormally scarce here. Whenever any rain fell in this region the baked and naked earth shed it like a roof, and it ran off into the ravines and canyons all about, leaving the land as dry as before. To collect these waters, together with that derived from the melting snow on the mountain tops, canals were constructed girdling the northern mountain group and leading into the reservoir lake which had been prepared to receive them.

There are advantages in ditching on a mountain side, for there by properly laying out your course, with very slight changes in the direction of your ditch, you can make it so that the water will run either way; you can gather the drainage from all the higher levels and conduct it where you please. Here in effect eave troughs were laid all about the 900 square miles and more of roof, of which the four great peaks of the northern group are pinnacles and cresting, while the valley above the newly-built dam constituted a cistern to receive the water which these eave troughs would collect. These collecting canals, however, were not simple ditches; besides being built in

the most substantial manner that engineering science could devise, in each descending valley where it was possible to do so auxiliary reservoirs and ponds were constructed on them; these when once filled served to equalize the flow and make it constant, at the same time nearly all the sediment washed down from the higher slopes is deposited in these auxiliary ponds and the water comes to the main reservoir transparent and pure.

Similar collecting canals were at the same time constructed on the south side of this reservoir to collect the water that might fall on the higher plateaus in that direction and on the northern slopes of the Abajo mountains, in which those plateaus terminate. This added a thousand square miles more to the roof that collects water for this cistern, and though as arid as any roof, the combined 1,900 square miles of water shed proved ample to fill the reservoir and provide a very good outflow the next season after the works were constructed. After the change of climate caused by the great flue and the glacier of San Bernardino, the precipitation on these heights became much more copious and more frequent, then these slopes and plateaus also were planted to forest trees, and now, here as elsewhere, much of the water that formerly ran off the earth, as it would run off a roof, is retained by the roots and leaves to percolate into the earth, some of it to reappear in springs, and to be delivered with a steadier flow free from the mud and gravel that formerly were carried in the torrents.

Here, as everywhere now, the desolation of the desert has disappeared, the young forest clothes the mountain sides as with a garment, while the new lake at our feet vitalizes the great mesa yonder and supplies the city of Mount Ceres with water enough so that fountains may gush at every doorstep and rivulets laugh by every wayside.

CHAPTER XXXII.

Fort Goodwill and Mount Ceres are more densely peopled than New Utopia, though there are in New Utopia more people to the house than in either of them. In New Utopia the great edifices admitting grandeur of architecture, and containing many apartments, predominate, while small individual houses are interspersed for variety. In Fort Goodwill and Mount Ceres small private houses predominate with large public buildings regularly distributed among them, and with occasional blocks of apartments thrown in for variety.

The plan of Fort Goodwill and Mount Ceres is geometrical, its purpose being to group together as many residence lots as possible on a given area, while making those lots ample for lawns and flower gardens, for shade and sunshine, and at the same time providing the most direct lines of passage possible in every direction.

The plan of New Utopia is esthetical; essentially the city is a park, the buildings being worked in with prime reference to preserving its beauty as a park, while furnishing all possible conveniences to their inhabitants. Primarily Fort Goodwill and Mount Ceres are cities, the park features of their residence portions being secondary, and their special parks detached.

The cities are for different purposes and for different classes of people. Fort Goodwill and Mount Ceres are industrial cities, their people are mostly under fifty years of age, are encouraged to be householders, and usually have families of the normal size. Children need a home all their own, with direct access to the earth. An hotel or a block of flats is no fit

place for them; but with the veterans retired at fifty it is different; their children have usually reached maturity and have homes of their own; the old people need the closer association with their neighbors, which a well-appointed hotel or block of apartments permits. New Utopia is chiefly for this class.

No one is required to leave the scenes of his active life on reaching the age of retirement unless he wishes to do so, but the privilege is open for such veterans among the citizen tenantry to make their homes in New Utopia if they so desire.

Those in active life are held subject to transfer to other localities if the needs of the service require such transfer, but in practice such transfers are always made by volunteers.

And yet Fort Goodwill and Mount Ceres are pleasant cities in which to live. Their houses though small are all artistic; well tended roses and flowers of many kinds bloom about the porches. All have ample lawns and space for the cultivation of flowers according to their fancy, and all front on streets that are park avenues, with well shaded lawns and no fences. Groves of trees growing on the open corners in the varied beauties of many species peep over the smaller houses, and offer most inviting shade in the angle squares of the blocks and at the intersections of the streets and avenues. The great public halls at the corners of the blocks lift their columns, their domes and their towers, over and among the graceful tracery and waving branches of trees chosen of such kinds as will best adorn the place where each is planted.

The parks are more forest than glade; of clipped lawns and groups of shrubbery and trees trimmed with artful precision, of nature combed out of all resemblance to herself, one grows tired, but of the forest and nature uncombed one never tires.

The long range beauty of the Fort Goodwill landscape, the purple and the azure of the distant mountains, the varied outlines of the peaks against the sky, the swelling shoulders of the nearer hills, the cliffs and the terraces, all these remain as they were. Their changes, for all things change, are of the aeons of eternity, not of the years of man; to man these greater features of the landscape are as if they were eternal, for they are of the mountains and the amosphere, but the desolation that once spread over the foreground has departed.

How desolate is a treeless land! Buildings most perfect in their architecture are dreary and naked and tiresome until clothed and veiled with trees.

How beautiful a thing is a tree! How surpassingly full of beauty is a forest, where nature, while pruned with a loving hand, is not restrained with too tight a rein nor combed too smooth! His eyes have not been opened who cannot feel the sentiment so beautifully expressed by Francis Bourdillon:

> "O'er land and sea I'd travelled wide,
> My thought the earth could span,
> But wearily I turned and cried
> O little world of man!
>
> "I wandered by a green wood side
> The distance of a rod,
> Mine eyes were opened and I cried,
> O mighty world of God!"

The eyes of these people have been opened; the flowers of the field and the wild things of the wood have come to share their loving regard, and the pretty creatures of the forest have grown tame. When the school children play in the groves the squirrels hop about among them, or, with their tails curled over their backs in Hogarth's line of beauty, they sit up on their haunches before the children to beg for food; and they seldom

ask in vain, for every child has learned to carry a cracker or two in his pocket to feed them, and there isn't a child among them that would betray the confidence of a squirrel or hurt it for anything in the world.

"He prayeth well who loveth well both man and bird and beast,
He prayeth best who loveth best all things both great and small,
For the dear God that loveth us, he made and loveth all."

And that is the kind of religion in which the people of Fort Goodwill are training their children.

But it is to spy out the land that we are come, and we will take an excursion to the canyon and thence down that mighty gorge until we can turn and come back by another way from that by which we go.

There are but two of us for the trip, you the reader, and I the writer. For our conveyance we take light, single, motor cycles; starting in the early morning while yet the dew sparkles on the grass and the flowers and the robins are singing their morning song.

This is not a fashionable hour, but if any unfortunate has never experienced the pleasure which the freshness of the day's awakening in early summer has to give him, let him try it, better at an even earlier hour, before the sunrise, and feel the thrill, the exhilaration, the delight with which nature awakening from sleep will inspire him.

Our way lies through the southeast avenue. Three and a half miles from the city hall our course is through the city. The rising sun low down on our left sends long, slanting beams of light through the openings among the trees and shrubbery and houses across the perfect pavement. These morning rays

illuminating the clustered groves and columned porches on our right make the festooned roses and the iris and the daffodils, the honeysuckle, the clematis and the ampelopsis to sparkle and glitter with a myriad diamonds of dew, and the odor of pinks mingled with roses permeates the air of this glorious June morning, while our motor cycles, light but strong, coursing swiftly side by side and curving obedient to the slightest impulse, fill us with a sense of freedom and of power. Ten minutes carry us to the border park which encircles the city on its southern or lower side. Here the landscape gardener's art finds free play, with all the resources of nature, from the largest trees of the forest to wild flowers and the grass for its material.

Three-quarters of a mile diagonally across the park brings us to the descent from the terrace, which we remember coincides with the altitude of 6,000 feet above the sea. To the slope of the lower plain the descent is 250 feet, which the grade of the avenue distributes through half a mile. This declivity is included in the border park.

At its foot we come to the high level irrigating canal from which the orchards are irrigated, and crossing this channel we are in the orchards. Here apple trees, in prime vigor, broad spreading but well trimmed and clean cultivated, cover the earth until their branches almost meet. The young apples at this season we cannot see as we ride past, because small and green; to the eye they blend with the leaves. A month ago these trees were in blossom; there were forty square miles of apple blossoms in this orchard. The odor of the apple blossom is not strong, but it is characteristic, and we are told that when this orchard is in bloom it is distinctly perceptible a hundred miles to the windward.

Our way is broad and straight and well paved, but there

are no fences to harbor weeds and obstruct the view and impart to wayfarers a sense of limitation. The birds here are myriads, and they make this orchard vocal with their morning song. The American robin delights in the forked branches of an apple tree above all places for its nest, and they, together with the song thrushes and nuthatches and waxwings and whippoorwills and nighthawks and swallows, and others, a selected variety of insectivorous birds are colonized here, and fed according to their needs; they are well worth their keep and more, for their aid in destroying harmful insects.

Three and a half miles through this orchard and we come to the main irrigating canal, which we cross. Beyond this canal to the forest bordering the canyon all to the right and southward are the lands cultivated under power. Our road, however, turns to the left up the canal.

In this direction the canyon's border draws near to the level of the canal, and the land growing steep and rocky is devoted to timber.

Our road enters the forest within a mile of the bridge by which we crossed the canal. Here on the border between the cultivated land and the forest we come to the first fence we have seen on our journey. It is a strong and high one of woven wire, designed to keep the deer that inhabit the woodlands out of the cultivated fields. A gate in this fence across our road opens at our approach and closes again automatically. We plunge into the forest where our road becomes a curved one, winding according to the lay of the land. A mile and a half of this brings us to the head of the incline by which we are to descend into the canyon.

Up the canyon five miles further east there is another incline similar to this, and at that point also is the main bridge

crossing the canyon to the White River division of the agricultural lands. The approach to that would have taken us five miles out along the eastern avenue, and that would have been the course for us to have taken if it had been our intention to go up the canyon to the great dam, or to have visited the nurseries of the board of forestry, which are not nearly so extensive now as they were twenty-five or thirty years ago; that route, however, would not have taken us through the orchard, which we wished to see, and we are going down the canyon instead of up.

The incline by which we descend is a double covered way with a moving platform on each track, one being up when the other is down. It operates like an ordinary elevator and needs no attendant. Wheeling our cycles on the platform we enter and descend.

Our road now winds along the bottom of the canyon. The bed of the river since the water has been diverted to the canal above is usually nearly dry, but there are bridges over the channel where its windings intercept the way; where jutting points of rock encroach there are tunneled arches cut through, or galleries cut in the face of the overhanging wall; where craggy places and precipitous cascades intervene, smooth causeways of stone have been built.

For motor carriages or bicycles, or horseback excursions when parties prefer that mode of travel, a beautiful road has been constructed along the bottom of this canyon all the way from the great dam to its junction with the Grand River canyon below Mount Ceres, where the great Colorado canyon begins, and along the course of that it is now in progress.

Here of old all was naked, inhospitable, savage in its wildness. Now the rocky walls of the canyon thrust their promontories out through the foliage of a hundred kinds of trees

while their precipitous sides are draped and festooned with clinging vines. Groves of mountain spruce thrust up their dark spires to peep over rocky ledges out of the depths of precipitous abysses rendered more dark and deep and grand by their presence. Here the hemlock drapes with its dark feathery green the precipitous sides of a hundred rocky gorges. Young hemlocks: what can be more beautiful than they, combining as they do all the graces of the evergreens and the deciduous trees, their plumy spires with heavily drooping branches impenetrable to the eye, their myriads of dark green glossy leaflets each spread so flat, all set so thickly in the spring and early summer with delicate tassels of pale green at every growing point, followed later in the season by clustering little cones turning from pale green to brown, and at all times loading every breeze with their fragrance.

There's grandeur in pine, and there's beauty in cedar,
  In the beech and the oak and the ash tree so tall,
In the droop of the elm, in the spread of the maple,
  But the young growing hemlock outshineth them all.

Along the margin of the channel cluster the white boles of the sycamores with their thin spread branches, their broad leaves, and in the fall and winter their dangling clusters of balls hanging on the branches after the leaves have fallen.

Yonder on the sunny side of the chasm spread the fern like whorls of the butternut leaves on their irregular sprawling branches, and, just a shade darker in color and smaller in size, more compact in habit of growth and stronger in odor, is the similar foliage of its cousin the black walnut. Nearly every tree of the forest has its characteristic odor by which a blind man might recognize it.

Over the tops of the cliffs above bend the branches of the

white oak and the sugar maple; on the flats in the bottom, mingled with the sycamore and the willow, are the widespread drooping branches of the elm; here and there on a dry knoll of talus, singly or in clusters, rise the dry stiff forms of the hickory, and the broad leafed basswood, so prolific of honey and buzzing with bees, spreads its shade over the way in a hundred places. The wild grape vine here and there climbs among the branches of the trees, now in their season not less interesting to the bees than are the basswoods. The cucumber tree also is here, and the pepperidge, and the chestnut, and where the walls open a cool face to the northward with damp ground at their foot the white cedar raises its graceful spires in groups and clusters, and sheds its fragrance in the air. In fact one who knows the trees and loves them, whether he comes from the north or the south, the east or the west, on this journey can scarcely miss any acquaintance.

And squirrels play among the branches, and now and then with a whirr the ruffled grouse or partridge, the drummer of the maple sugar camps, starts up and darts away like a rocket; later in the season, when brooding young, the mother bird of this species will flutter away from the foot of the passer by as if wounded and disabled, while her chicks hide themselves under the leaves, and one who knows their habits can gather a hatfull of the little brownstreaked beauties; when he has observed them to his satisfaction and let them go their mother will quickly take charge of them again.

If we sit quietly a while on one of these mossy fragments of rock a little back from the wayside, the wild deer, shy but not afraid, will come to see us. They stand at a little distance striking their fore feet nervously on the ground, starting away at any sudden movement but timidly approaching again. If wooed with a lump of sugar or of salt they will approach and

lick the hand that offers it, for these beautiful creatures have never known anything but kindness at the hand of man, and the degree to which they are able to perceive the spirit and divine the intention of their human visitor is wonderful.

These wild deer, so swift, so graceful, with such noble dignity of bearing, with their antlers spreading so finely, when such a creature honors man with his confidence one is tempted to take off his hat out of respect, but don't do it, or the deer failing to understand the gesture will leave you very suddenly.

Returning to our cycles now, we resume our journey. Pushing on through such scenery as we have already passed until we pass the opening of the White River canyon, our course has turned from south to westward.

Soon we come to a high promontory that rises on the left or south side of the canyon. This is Observation Point, and here is an elevator which leads to its summit. We can have no use for our cycles above so we leave them here, taking with us, however, the lunches which we have brought for our mid-day meal. Entering the elevator car we push the button that connects its motor with the electric current and rise to the summit.

The lift from the bottom of the canyon to the top of this promontory is 1,060 feet in vertical height. On this height a pavilion has been built and a grove planted. There is also a reservoir here which is filled from a high level source by pumping, for the auxiliary irrigation needed by forest lands at high levels in this vicinity.

This point is directly south of the peninsula of agricultural land that constituted the first wheat fields back in the hurry season of '14.

The whole Fort Goodwill agricultural district lies spread

about us like a map. Bearing a little east of north we look up the course of the Green River canyon down which we have just come. Toward the northwest we look directly up the auxiliary canyon of the Uintah, and coming in at our right from the east, the canyon of the White river lies darkly bowered in forests like the others, while winding past us on the west and stretching away toward the southwest lies the downward course of the Green River canyon into which all the others converge, growing wilder and deeper as it goes, as the mountains rise higher on either hand.

Framed between these canyon borders set in forests, to the north of us lie the agricultural lands of the Fort Goodwill point; their central aqueduct, the first constructed of its class, dividing the point into its eastern and western halves, appears as a straight line of granite grey, which if continued would pass us on our left. The lines of power sheds extending east and west at right angles with the aqueduct give a delicately striated appearance to the fields; the portion beyond, where the power sheds lie north and south, taking their origin from the canal instead of from the aqueduct, is quite distinct to the eye but though from three to six miles in width it appears to be but a narrow belt.

Beyond this a dark bluish strip marks the Fort Goodwill orchards with the terrace of the border park behind it. And there beyond, backed by the towering peaks of the Uintah mountains, is the city; taking one of the field glasses, which are kept here for the convenience of visitors, we can distinctly see many of the large public buildings, while here and there the smaller dwellings gleam among the trees that surround them.

The industrial district at the left of the orchard may be

distinctly seen. The mountains behind all this would not seem to an eastern eye more than ten miles away at the farthest, and yet the city center yonder is twenty-four miles north and about five miles east of this point, and when we have reached it we are less than half way from here to the peaks beyond.

There on our right, eastward of the Green River canyon, the White River division of the agricultural district lies spread; this is four times as large as the Fort Goodwill point and cultivated under power in the same manner. In this direction the western Rocky mountains in Colorado form a background to the view.

Out on our left, beyond the Green River and the Uintah canyons, lies the western division of the agricultural lands with the Wahsatch, and the Western Uintah mountains behind them.

East, west, and north, all this great expanse is green with growing crops. The southern quarter, from which this promontory is a projecting point, is a rocky mountainous district unfit for agriculture and devoted to timber.

In the canyon's gorge, as it winds about the foot of this promontory, the white trunks of the sycamores twinkle among the green leaves; seen from this height the canyon walls dwindle into insignificance. There is a belt of forest everywhere along their borders which spreads to fill all the triangles formed by the obliquity of the canyons to the direction of the power sheds, and some of these triangles contain from 80 to 100 acres, so that these forests along the canyon borders are quite extensive. These triangles, with abundant water from the irrigating mains, were the first land available for forest planting, hence, though even here the trees are yet young, they are nevertheless better grown than on any other portion of the

woodland, and for several years there has been an increasing supply of poles and small timber removed to thin the growth in order that the remaining trees might thrive the better. The borders of these woods next the fields present a bank of foliage from top to bottom, relieved here and there by deep, dark recesses, and at other points by the brighter green tipped with sunshine where a prominent branch or tree-top thrusts itself beyond the general contour into the outer light.

As we look down on these forests from this height no individual trees are seen, only billows of green, varying in tint according to the kind of trees, all fading into azure grey as they recede into the distance.

Yonder where the woods stand out so darkly distinct from all the rest are large groves of pine, cultivated for the timber which they will yield; this is the only kind of timber cultivated as a distinct crop and permitted to occupy the ground unmixed with other trees.

Over there on the point opposite, mingled with other trees the better to fill the ground, the whitewood or tulip trees are thickly sprinkled. They are easily distinguishable from this height by the deep, glossy green of their leaves, differing in tint from those of any other tree.

There the sugar maple abounds and yonder the white oak, each imparting its characteristic tint to the forest, but each mingled with beech and trees of many other kinds. Belts and scattering trees of hemlock and spruce are distributed among these deciduous forests, both to improve the shelter which the woods afford in winter and to enliven the view when the leaves have fallen from the other trees.

The conifers native to this region, the nut pine and the mountain spruce, are also cultivated, but they are mostly

reserved for the higher and dryer slopes above the level of irrigation.

Here, too, in suitable places, the giant sequoia of the Sierra Nevada has been planted, and though small yet, on account of their youth, the young trees are thriving; it is probable that some of them may be growing yet in the remote future when the period of history from which we are now passing will seem as strange and unnatural as that of the cave men seems to us.

But the charm of this landscape that is spread before us varies with the season. When in the autumn the leaves ripen and these forests glow in buff and scarlet and crimson, all set off against the dark background of the evergreens, it is a glory all unknown to this region until of late.

But we have eaten our lunch, and for nearly two hours surveyed the landscape from this pavilion. We will again take the car on the incline and descend.

Mounting our cycles, again we are off, taking our way down the canyon yet as if continuing our journey away from Fort Goodwill, but within two or three miles we come to an auxiliary canyon opening into this from the right, and a branch road coming down to join that on which we are traveling. We take the branch, and directly are spinning on our way up the Uintah. The scenery takes on the changes to be expected on an auxiliary which is the course of a smaller stream, though since the waters of both have been diverted into the irrigating canal the size of the stream counts for little in either case.

The bed of the Uintah in the lower eighteen miles of its course makes as great a descent as the Green river makes from the great dam to its confluence with the Uintah, a distance of about seventy miles.

Hence we find the canyon obstructed by cascade after cascade, and to pass these obstructions our road often winds along the face of the bluff and out into the woods on the slopes above, for, though the channel here is more rugged and steep, the walls of the canyon are more broken and not so high. The road is good, however, all its grades are easy to our motors, and we wind about from ravine to valley and from valley to hillside, all thickly wooded. In these woods on either side of the road a crisp carpet of last year's leaves covers the ground, with those of the preceding year under them, and of the year before yet beneath, and so on, until the decaying leaves melt at the bottom into the black mould of the forest. Vegetation here takes on a character familiar to our boyhood; here are our forgotten friends that in the east seemed to have been exterminated with the forest; our foresters have taken pains to introduce them, and, finding conditions favorable, they have flourished.

Yonder the mandrakes are marshalling their umbrella brigades on the slope, and there is the rue anemone with its delicate foliage overstrewn with dainty cups of white, and the cimcifuga with its slender racemes of delicate fringy white blossoms, and the blood root with its great lone stars of waxy white with radiant golden centers, each star on a juicy scape lifted above the broad, smooth leaves with their regular deep carved outline, and occasionally we see a belated cluster of the wild phlox, which a little earlier made the half shaded openings along the canyon's margin gay with their lilac blossoms.

If we had been here when the leaves were just bursting their buds on the trees we should have seen sprinkled over these banks the hepatica blossoms with their pale faces just blushing with pink, or some of them blue and others white;

and the adderstongue, each thick, juicy, mottled leaf folded about the scape of a single, small, yellow lily, so delicately fragrant, from which six great brown anthers dangle, each suspended by an almost invisible thread; and the spring beauties with their clustered bells of pink satin streaked with crimson, but the season for these has gone by.

The pink blossoms of the wood geranium are here now, and there is the cypripedium, the ladyslipper of our boyhood days, with its yellow sacculated flowers and the odor so characteristic of the orchid family.

And there is a dainty darling of the woodland, the Dutchman's breeches, dicentra cucularia; it would be a dull soul that could find no pleasure in the sight of these nodding racemes strung with dainty garments of waxy white, each tied at the waist with a golden ribbon; their foliage, fine cut but smooth, with the dusty bloom of a ripe grape on its surface, clustering close on the carpet of dry leaves, and these racemes of fairy garments drooping over the cluster, they can never look so well with any other setting.

There in that rocky glade at the edge of the channel just above that cascade a cluster of sweet elder bushes are spreading themselves among the jagged rocks, and just now their broad, flat cymes of blossom are covering the green of the leaves with white, and their fresh odor is wafted to us as we ride by. And there in the grassy swale above is a cluster of wild tiger lilies more delicate and prettier far than the garden variety. And dressed in flaming scarlet yonder is the cardinal lobelia, and its cousin, the great blue lobelia, too, is there close by. And here on the edge of the glade is a bank of blue violets, and there the wind flowers are shaking their white chalices.

Now we pass a rocky angle by the canyon's margin, over which the wild grape vine has spread itself and climbed into the trees above; it is in blossom now, and the air is filled with the odor of its flowers like that of mignonette. But here our road leads into the thick woods again, and we speed our motors a little as we spin along the meandering way.

Through such varied scenery we run about fifteen miles, then we come to a fork in the road. The way on the left continues through forest and glade up the course of the Uintah river, but we turn to the right.

Within a minute after passing the fork of the road we come again to the wire fence separating the agricultural land from the forest, and, as before, a gate opens automatically to admit us and closes again when we have passed through, one of our vehicles having of course been guided over a little platform in the pavement which pushes a button and sets in motion an electric apparatus that opens and shuts the gate.

Now the way lies directly northward five miles straight before us. On our right is one of the fields of clover; it is now in blossom, and its fragrance is heavy on the air. Close by us on the left is the power shed with its long line of shafting and pulleys and its irrigating main set in the stonework beneath, and in the pavement under our feet is the steel track of the agricultural service railway.

Following this about three miles we come to where they are cutting clover for the cows; it may be worth while to stop a minute and watch the process. Yonder in the middle of the field is the mowing machine approaching us with a car mounted on broad rollers attached behind it.

The cable which moves them is running over the pulley there and through a guide fixed just outside the railway track,

which holds it on the edge of the stubble that was cleared by the previous trip of the machine across the field. The machine is cutting a strip eight feet wide as it goes, and the clover as it is cut falls on a moving apron which carries it into the car behind. There the attendant, the only man that travels across the field with the mower, using the apparatus provided for that purpose, distributes the clover on the load. In cutting across the field and back an acre of ground is cleared and the green clover gathered is a heavy carload.

But here it comes. Now the car and its load are lifted on a kind of jack worked by the electric current, and turned over the steel track. The broad rollers are then removed, the car wheels are adjusted, a trolley is set in the guard post at the rear of the load, and away goes the car with its load to the cow barns.

The rollers are now placed on the axles of the empty car that has just arrived, it is attached to the mower and the operation is repeated.

This is going on during the entire growing season in many fields, some of clover and some of other forage plants, for it is found that the cows thrive best on a mixed diet and their tastes are gratified.

But now we follow the loaded car out of the field. Five miles from the gate by which we entered from the forest we come to a small tract of woodland again, occupying the angle formed by the obliquity of the canal to the borders of the fields. On the farther side of this lies the main canal with its electric railway tracks skirting its banks; the car loaded with clover here turns to the left, but we cross the canal and turning to the right soon reach the southwest avenue of Fort Goodwill.

Our road now lies straight before us toward the northeast.

On our left is the industrial district with its many and varied factories and its many electric railway tracks which serve them. For a mile we are passing the section devoted to the iron industries, which reaches back toward the northwest three miles. But this is the hour when a new relief takes charge in the works, and the men relieved now come pouring out, a great throng, from all these cross streets into the avenue; some are riding on single motors and bicycles, some on small motor carriages, but the majority in automobile omnibuses. We ride along with the throng. Now we are passing the machine works, then the fiber board works, the cotton and the woolen mills. These streets opening into the avenue from the left reach three miles back lined with great factories and industrial equipments of every kind.

Now we come to the coal yards and the gas works, but here an innovation has been introduced since the works were founded.

All the young forests need thinning as the trees grow. The wood gathered thus far has been too small to be valuable for lumber, but it is all available for fuel. It has been found that this wood will produce gas even superior as fuel to that obtained from coal. There is no waste in it, even the ashes remaining after its final combustion being of great value in the fertilizing department and in the arts for the chemicals they contain. Hence, with the increasing supply of wood the amount of coal mined is growing less year by year, and the coal mining forces are being drawn off into woodcraft, which is a more wholesome as well as a more esthetic occupation.

In these works everything is conformed to the conditions of the greatest efficiency of machinery and force, but this being secured, pains are taken to have the surroundings neat and tasteful.

On the opposite side of this avenue from the industrial district, that is on our right, lies the border of the great orchard that we passed through some twelve miles further west. We are passing by it here for three miles before we reach the high level canal that separates the orchard from the border park and the hillside rising to the city plateau.

In the park above this hill the throng of workmen in their automobiles and on their bicycles begins to scatter, turning through the parkways this way and that to enter the city at points most convenient to their homes. Our way, however, lies straight before us to our hotel on the border of the city hall park.

As we enter the city we notice that there is a display of many flags at half mast and at intervals the city chimes sound a dirge.

Enquiring what this means, we are told that the old General, Theodore Goodwill, last night passed into the higher life, his body being found cold in his bed at 9 o'clock this morning; his obsequies are to be held three days hence in New Utopia where he lived. Thousands from every city in the land will attend the ceremonies on that occasion, and we will do so with them.

CHAPTER XXXIII.

Again by the hundreds of thousands the people are pouring into the great auditorium in the mountains above New Utopia.

Since the occasion of the great celebration, when General Goodwill delivered his valedictory address and the army was disbanded, great improvements have been made in this auditorium. Over all the floor of the valley a smooth level pavement has been laid; the speaker's platform is now of solid stone; in the clefts and irregularities of the rock walls of the valley receptacles have been built and filled with earth in which ornamental trees, shrubbery and flowers are cultivated, and in the solid rock constituting those walls chambers have been excavated and adorned with architectural portals surmounted with sculptured figures. In these chambers camp chairs are stored in numbers sufficient to cover all the floor of the valley with seats. There also the canvas is kept with which, on occasions when the valley is used as an auditorium, the whole is enclosed, together with the mechanism for putting and holding it in place, the auditorium telephones, and other furnishings.

All these are now in their places on the floor; the great tent covers the valley, flags float from the central masts half lifted. Palm trees of stately dimensions have been conveyed here and ranged in three lines, one extending in the same line with the supporting masts of the tent and one on each side near the border, and the whole valley has been embowered in greenery and flowers in such a manner as to soften but not to obstruct the view. A glory of shining silk drapery radiating

from the sound reflector and covering the rock walls above and on each side of the platform terminates the vista.

Music soft and melodious fills the air.

For this occasion pneumatic tubes have been laid from the crematorium in the pine grove to the altar that has been built yonder on the platform, and thence to that which conveys the ashes of the dead to their final destination.

This vast multitude are gathering now to pay their tribute of respect to the memory of General Goodwill; his friend, and, during the last years of the army, his chief of staff, is to speak to the people in honor of the departed.

With appropriate music the ritual commonly used on such occasions is followed, then the speaker steps forward and addresses the people thus:

"In the presence of the hundreds of thousands assembled here to honor the friend, comrade, and leader, who has so long walked with us, what shall I say? His was the rare good fortune to open the door admitting mankind to the wealth, the joys and the blessings with which the universe is bountifully rich, and enabling each and all to participate in the culture and the knowledge that go to make life worthy, yet he was in no sense a great man. Thousands have lived before him who were capable of doing for the world all that he has done, but who were forbidden by the unripeness of the time or the circumstances into which they were born from doing the deeds and accomplishing the reforms for which their souls longed, even though the way was as clear to them as it was to our friend just gone from our sight. Often it was that 'Chill penury repressed their noble rage, and froze the genial current of their soul,' and the world, in so far as it has noted them and their aspirations at all, the blind old world, has pronounced their lives failures and their ideas impracticable;

it has imagined that their lives were ended and that their purposes had perished with them.

"Foolish old world, and blind! Little has it thought that since the days of Siddartha, Socrates and Jesus, in that other world pervading this of matter, these lesser lights that were accounted but as darkness, together with the greater, have continued the struggle, inspiring the minds of such among men as were fitted to receive their inspiration, preparing the world both on our side of the curtain and on theirs to receive the good things which from the beginning the architect of the universe had prepared for his children.

"Heaven could not be heaven until the earth could be heavenly also, for the universe is a unit. So long as earth pours forth brutal souls into the other life, even heaven is rendered powerless in proportion to their number and their wickedness, and hell pervades this world and the other also. But in this struggle of the ages no soul ever ceases to exist nor does the desire of any soul cease to exert its force.

"It could not be otherwise than that ultimately right must subdue wrong and wisdom overpower foolishness, and in our time the great souls and the enlightened of all the ages that have preceded us have been able to sway the course of events as never in any preceding age was possible.

"This, then, was the rare good fortune of our friend who has gone before us; in the fullness of time when the world was ready to be led he was in the position to lead, knew the way, and was eager to walk in it. His opportunities corresponded with his abilities and with his desires. If Theodore Goodwill's life had been cast in other lines and he had lived a few years earlier, with all his ability, his knowledge, and his aspirations, he might have died unknown and a pauper.

"And yet, if it had been so, though the world would have counted such a life a failure, without influence, a waste and a loss, the world would have been in error; all such lives that have gone before us are contributing factors to the triumph of their purposes which we now enjoy, and they are enjoying it with us.

"Not yet is it generally realized how short is the road that the human mind has traveled from infantile limitations, nor how recently it started on that journey. In the infancy of the human mind the earth was to men the largest body in the universe, inconceivably great, practically infinite, though the concept of infinity had never dawned on their imagination. The sun, moon and stars were regarded as small and near, space at large had for them no existence and their imagination did not reach out toward its void to wonder about it; men thought and imagined only within narrow limits, a little beyond their bodily reach, and in terms grossly tangible to the bodily senses only.

"These were the limitations of infancy; as mankind have conquered fundamental truth and assimilated it and made it their own they have departed from these limitations, but such truth, while it is reached by a process of investigation, research or reasoning, is not wholly conquered and assimilated. Truth when so conquered is like the earth under our feet, we are not thinking of it, nor working to get a footing on it, but we stand on it and look from it as we direct our attention to other things. It constitutes our point of view, and the difference which the point of view makes in the outlook is vast; under infantile limitations mankind were looking from the valley and nothing could be seen but the near at hand. But having conquered fundamental truth we stand on a peak and a great landscape lies spread before us.

"It is not until such fundamental truths become a part of the basal plane upon which the mind stands, held unconsciously, without question, to be thought from, not to be thought to, that such truths have become steps in the way of departure from infantile limitations.

"The first such step which the common mind of man has taken has grown out of the establishment of the truth of the Copernican theory of astronomy, but after the truth of that system was established the world was very slow to take the step. Copernicus lived in the sixteenth century, but not until the nineteenth was the step taken leading out of infantile limitations of the mind, which grew out of the truths which he had established. That step, growing out of the realization of the immense distances of the stars, and the fact that such distances might be multiplied indefinitely, was the establishment as a fundamental truth to think from, of the concept of the infinity of space.

"The second such great step in the enlargement of the human mind grew out of the science of geology, and as the first step had consisted in the establishment among the fundamental data of the mind, of the concept of infinity in space, so this consisted in the like establishment among these data of the concept of the infinity of time. But the first step had prepared mankind for the second, and it was comparatively but a short time after the truths of geology became known before the step was taken. These two and no others, space and time, are yet the infinities realized by the human mind.

"The third step of enlargement comparable in importance with the other two was the establishment in the human mind, as a part of the basal plane to think from, of the evolutionary philosophy. This grew out of the ripeness of many sciences and the cross lights thrown upon nature by each; with its

establishment the names of Darwin, Wallace, and Herbert Spencer are associated in honor.

"It was the evolutionary philosophy that first made the universe intelligible, and its establishment as a step in the enlargement of the human mind would have been impossible until after the first two steps had been taken. This step may be regarded as accomplished by about the end of the third quarter of the nineteenth century.

"This step brings us to our own time and place in the progressive conquest of truth and the emancipation of the human mind from infantile limitations. A fourth step is preparing which shall bring with it the fruition of all the others. That step is to be, like the others, the acceptance as an unconscious datum of truth, from which to think, of the reality of the spiritual order in nature as an entity animating the material world, imparting consciousness to it, but separable and distinct from it.

"When that step has been fully taken, mankind in the material plane of being will grow conscious of the coming and going in larger freedom of those who have lived before them; they will recognize their presence as mentors and teachers and guides, in the higher and causal plane, of those not yet promoted to that plane, suggesting and inspiring our best thought in our hours of thoughtfulness, and playfully leading us through the realms of dreamland during our sleep.

"Our friend, leader and counsellor, General Goodwill, during the last eighteen years of his life, has rested from his labors, he will be with us yet, and his field of activity is enlarged, not curtailed.

"More and more, as the consequences ripen about us of the better social order into which General Goodwill was so largely instrumental in leading us, we shall become aware of

his presence, together with that of many others who like him have been transposed to the higher and more perfect plane of being, the spiritual order, until finally those who have gone before shall yet dwell with us, and we shall know them as we are known by them, and death will be but as the putting off of an outworn garment.

"We do not mourn our friend as formerly the dead were mourned; we have not lost him. He has been promoted to a larger freedom, and in his larger freedom we have learned to recognize his presence in a larger activity.

"But the ashes of our friend's body have come, and now we consign them, ashes to ashes.

"It is superfluous to say that these ashes are not our friend. Long ago when a little group of friends were gathered round Socrates as he was about to drink the poison, one of them, Crito, asked him in what way he would have them bury him. 'In any way that you like,' answered Socrates, 'only you must get hold of me and take care that I do not walk away from you.' So we might now do as we pleased with our friend if we could get hold of him, but between our friend and these ashes there is nothing in common.

"Ashes! To ashes let them be gathered. Dust! To the dust heap let it be conveyed. Neither our friend nor any one has any further use for these until in the laboratory of nature they are dissolved and reassimilated to build up living forms anew.

"Friends! Eternity is here. We are living in the midst of it; let us not forget this truth. And while duly sensible of the responsibilities of our citizenship let us rejoice that we are citizens of the universe forever. And let it be our joy while here, to go on with the work of perfecting the earth, in the

assurance that for whatever we can better it we shall find that heaven also will be the better."

Then swelling music filled the great auditorium and echoed among the rocky peaks above and rolled down the mountain side, and the fair city at its foot caught up the strain from every organ tower and prolonged it as the assembled multitudes departed.